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Smoke Rings

Steamship Models at Hertford

A FEW years ago I paid a visit to Hertford to see a display of a remarkable fleet of working model steamships, which were being shown in aid of the Mission to Seamen. These ships have now made another successful public appearance as an attraction in connection with Hertford War Weapons Week. They have all been built by Mr. Victor B. Harrison, who is well known to our readers for his interesting letters and contributions on model locomotive and railway matters. The fleet includes liners, cross-channel boats, and cargo boats, all modelled in a very realistic and true-to-scale fashion, and most efficient and reliable in their running. They were shown at the Corn Exchange in Hertford, and a special pond was constructed for the occasion in the centre of the hall. The marine superintendent in charge was Mr. Stanley Harrison, the son of the builder, and " V. B." himself attended for one afternoon to assist in running the boats, and to answer the many enquiries from interested visitors. I am told that a crowd four deep round the pond was not an unusual sight, and there is no doubt that this exhibit did much to bring in the entrance fees charged for admission to the general show. Magnetic ships, shall we say, instead of magnetic mines.

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More About 5-inch Gauge

SEVERAL readers, including Mr. Andrew Todd, still seem to be uncertain as to the advantages to be gained by using so-called " awkward " scales for model locomotives; and they assert that it is far easier, in the case of 5-inch gauge, to work to the simple scale of 1 inch to the foot and let the gauge be a little wide. Up to a point, this is true; but it does not alter the fact that models built on this plan do not satisfy the true locomotive lover, because, at a scale of 1 inch to the foot, 5 inches represent 5 feet, which causes distortion of the model. The true scale gauge for a 1-inch scale model is $4\frac{3}{4}$ inches, which was formerly the standard. It is little used today, except for 1-inch scale models built for exhibition purposes, in which all details are reproduced to scale regardless of anything else. Such models are seldom successful as *working* models, simply because the working parts are usually not sufficiently robust to stand up to the work required of them. To coarsen these working parts without increasing the width of the model is, in most cases, an impossibility; yet, with the increased popularity of the working steam model locomotive, an increase in the available space between wheels became a necessity. To achieve this, without distorting the model, became something of a problem, the obvious solution to which was a slight increase of the scale unit. What could be more logical than to make the scale unit 17/16 of an inch to the foot? This is double the standard 17/32 of an inch scale for $2\frac{1}{2}$-inch gauge, and therefore extended the scope of many drawings of $2\frac{1}{2}$-inch gauge locomotives, by making them applicable to 5-inch gauge, through the very simple process of doubling all the dimensions. But a far more important advantage gained from the increased scale unit is the greater space available for the working parts. The production of a model locomotive that is to scale in all its external features is easily possible, while the working parts can be made sufficiently robust to stand up to really heavy work. It is, of course, quite possible to construct a true-to-scale locomotive for $4\frac{3}{4}$-inch gauge, and it can be made to work; but its suitability for giving the service usually required from such locomotives is doubtful, while a 5-inch gauge engine, properly designed, will give almost unlimited service and will have a much longer life. In short, the 1 1/16-inch scale and 5-inch gauge, together, make it possible to build locomotives that are true to scale in all external features, and, at the same time, capable of giving really trouble-free service.

* * *

Sydney's Generous Model Engineers

I WAS pleasantly surprised when opening my mail a few days ago to find a letter from the Commonwealth Bank of Australia enclosing a cheque for £100. This handsome sum was cabled to me, through the Bank, for payment to the Lord Mayor of London's Bomb Victims' Fund, and the senders were the Sydney Society of Model Engineers. I would express my most cordial thanks to our Sydney friends for this generous gift, which will do much to bring welcome relief and assistance to those who have suffered from the tragically destructive air-raids on the poorer residential quarters of London. I am sure all the model engineers of the home country will be deeply moved by this kindly gesture on the part of the model engineers of Sydney, which is yet another indication of the brotherhood which is so characteristic of the followers of our splendid hobby. Our Sydney friends may rest assured that through the practical relief organisation set up by the Lord Mayor of London their most welcome donation will be well and faithfully applied.

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A Ducal President

I MUST congratulate the recently-formed Kidlington Society on having enlisted the interest of His Grace the Duke of Marlborough and persuading him to accept the position of President. I do not know to what extent the Duke is an active model engineer, but I am sure his gracious patronage of the Society will greatly please the members, and do a great deal to stimulate their endeavours to make the organisation a real and lasting success. I hear that the plans for the workshop have received official approval, and its erection is to be started forthwith. Any member of another Society who is temporarily residing in the district may enjoy the privileges of membership for a period of one month.

Percival Marshall.

A CAPSTAN ATTACHMENT for Small Lathes

A device for the expeditious and accurate quantity production of small turned parts in the home workshop

By " Ned "

THE differences between the lathes employed in most amateur workshops, and those intended specifically for quantity production on a commercial basis, have already been thoroughly explained to readers of the " M.E.," and it is therefore unnecessary to discuss the reasons why the amateur is unable to compete with the factory in output time and cost, in cases where numbers of identical parts have to be machined. The ordinary centre lathe, no matter how high its quality may be in respect of accuracy and design, is fundamentally intended to deal with work-pieces separately and individually, and its methods of operation do not permit of saving time on repeat operations to any great extent, unless some special equipment is provided for this purpose.

In the ordinary way, amateurs are rarely interested in quantity production, as it is unusual for them to encounter work in which any very considerable quantities of identical parts are called for. At the present time, however, there are many amateur workshops which have been temporarily converted into small factories, and are contributing in a modest way to the national industrial effort. It is thought, therefore, that some particulars of a practical device for facilitating quantity production on an ordinary lathe will be of general interest.

Let it be said at the outset that there is nothing new in the principle or conception of equipping a small lathe with devices for speeding up production. For many years now, equipment such as turret tool-posts and tailstock capstan

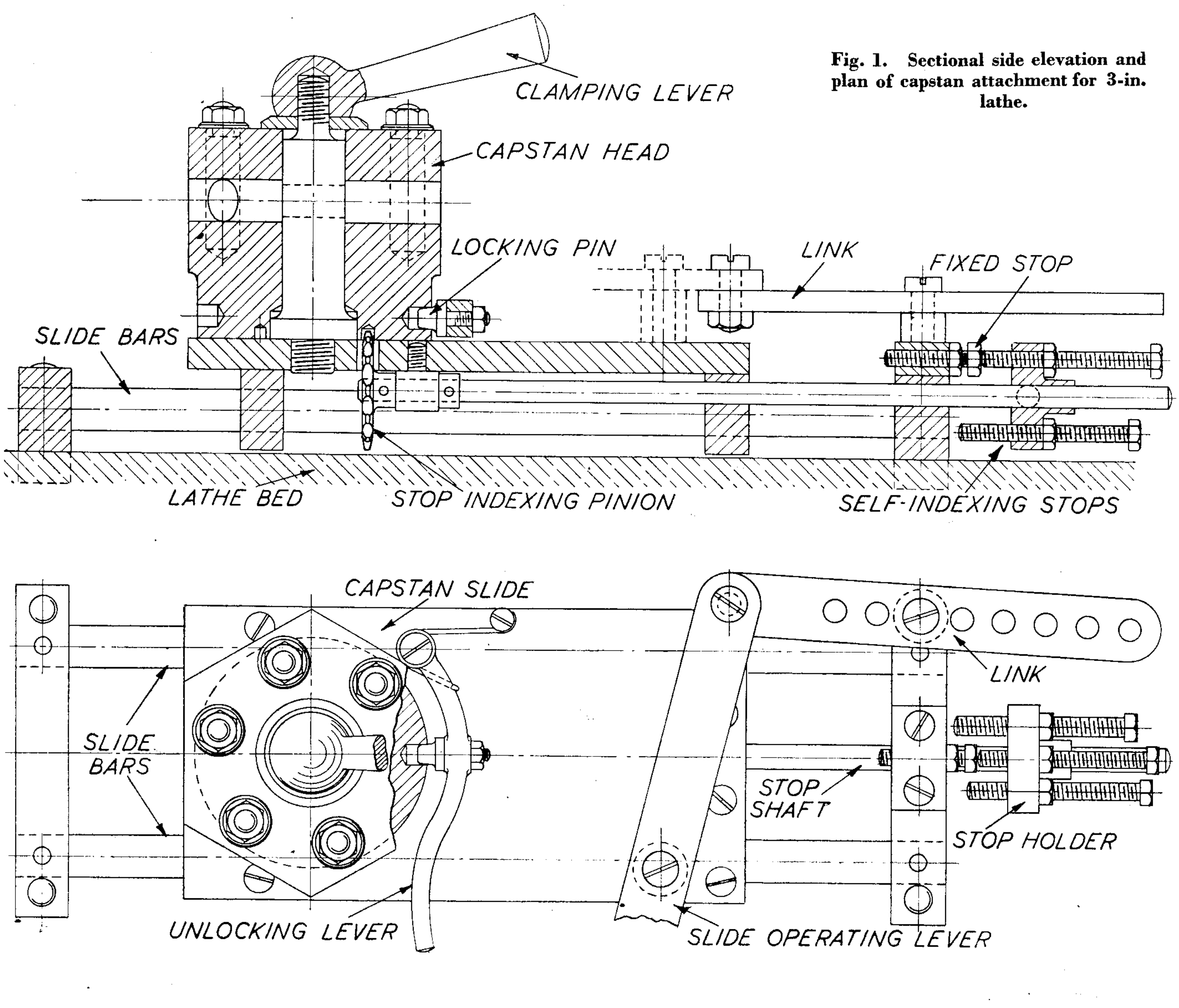


Fig. 1. Sectional side elevation and plan of capstan attachment for 3-in. lathe.

attachments have been available, and the last few months have seen a revival of many old ideas and the inception of several new ones, all having certain similarities of design and purpose. In practically all cases, the fundamental intention of such devices is to provide a means whereby a number of tools may be kept set up ready for use, and brought into action in very much less time than is normally required to change and re-set tools in the standard form of tool-post. This, of course, is the recognised principle on which the majority of lathes designed specifically for repetition work operate, and the familiar "capstan" or "turret" appears to be the most effective practical method of rapid tool-changing so far known.

Simple and Crude

Like many other fundamentally sound ideas, however, the practical application of such ideas to machines which are not originally designed to use them often falls very far short of what it should be, or might be, and in some cases the devices are very disappointing in use. As the result of a fairly extensive experience with all kinds of extemporised production equipment, dating since the beginning of the last war, the writer ventures to offer a design for a capstan attachment, of a size suited to a 3-in. centre lathe of the type generally used by the amateur, and adaptable to other sizes of lathes by modification of dimensions. It is specially designed so as to be capable of construction in the home workshop, the necessary machining work being carried out on the lathe to which it is to be fitted, and employing materials of such a nature as may be expected to be readily available. Castings or other parts which may be difficult to obtain, or may cause delay in production, and complicated machining operations which might be difficult to carry out in a small workshop, have been carefully avoided. As a result, the design is necessarily severely simple, and may even be considered crude; but to those who are primarily interested in utility, it should be sufficient to assure them that the one and only claim made for it is that it will work efficiently and accurately.

In order to explain in what respects this attachment is claimed to be an improvement on existing devices having a similar purpose, it may be useful to review the various forms of the latter, and to consider their shortcomings and limitations.

Tailstock Capstan Attachments

Most capstan lathes have the capstan slide mounted on the bed axially in line with the headstock centre, and in the location normally occupied by the tailstock of a centre lathe, as this position is found to be most convenient for dealing effectively with most of the operations carried out in such lathes. It is therefore logical to suppose that this position is also best for an attachment intended for similar purposes on an ordinary lathe. The usual form of capstan attachment, therefore, consists of a "capstan head" or multi-point rotating tool-holder, mounted on a tapered stalk which fits the tailstock socket. In some cases the head is in the form of a disc which rotates on a horizontal axis, in which case the space available for tools is somewhat restricted, and the idle tools may impede the view of, or access to, the work. This may be remedied by pivoting the head on an oblique axis, thus allowing the tools to be accommodated much more comfortably, and to be rotated over the top of the tailstock barrel.

But the weak point about any form of tailstock capstan head is that the ordinary tailstock barrel is fundamentally unsuited to act as a tool-slide. Its bearing surface is quite inadequate, and the only resistance to torque—which may be very heavy in the case of capstan turning tools—is provided by a key, which in many cases is by no means robust. In addition, the method of mounting the entire attachment on a slender taper shank leaves much to be desired, and apart from the small gripping surface of the shank, its overhang still further reduces the rigidity of the fitting to withstand loads applied by the cutting tools. These deficiencies are entirely beyond remedy while the device remains a *tailstock* attachment, and clearly point to the necessity for mounting it on a more suitable form of slide.

Turret Tool-posts

These devices certainly remove the objection just discussed, by making use of the main sliding saddle of the lathe to carry the rotating tool-holder. So far as steadiness is concerned, they leave little to be desired; but their principal limitation lies in the fact that if they are used in

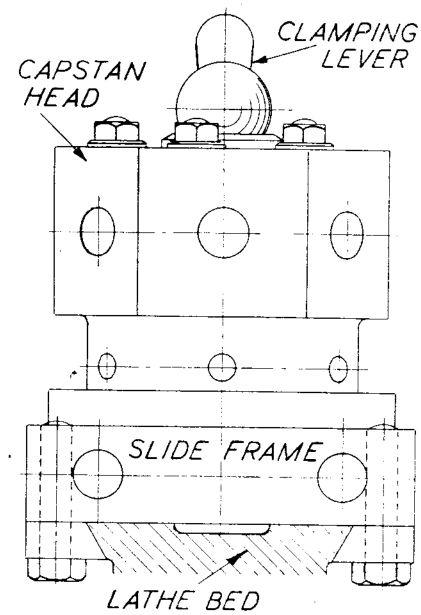


Fig. 2. Front end view of capstan attachment.

conjunction with the tailstock, it is impossible to bring the tools into the most convenient operating position, while, if used as a substitute for the tailstock, they limit the number of operations which can be handled. Capstan lathes are nearly always equipped with a cross slide, in addition to the capstan slide, for the purpose of dealing with forming and parting-off operations, which are a necessity in many kinds of work; and in adapting an ordinary lathe, it is most desirable that the main slide should be reserved for this function. It is, therefore, clear that any form of tool-holder attached to the main slide should preferably be supplementary to the capstan slide rather than a substitute for it. And this proves the desirability of adding a complete slide, additional to the main slide, for the purpose of carrying the capstan head.

Limit Stops

So far, all the attachments considered have been devised with the sole aim of eliminating or reducing the time normally occupied in changing tools. Admittedly, tool-changing is the principal source of lost time in ordinary lathe operations, but a good deal of time is also occupied in adjusting the tool slides to ensure that the work is machined to correct diameter and length. In a capstan lathe, means are provided for working to pre-determined dimensions without the necessity for continual checking and adjustment. The skilled craftsman is often inclined to

despise such expedients as a concession to the incompetent operator, but the fact remains that in addition to reducing the time taken to produce the work, they also make its accuracy practically certain, and eliminate the risk of the slips which are occasionally made by the best craftsmen.

The method adopted almost universally in capstan and turret lathes to ensure that the slide always travels the correct distance to produce work of the required length, is to use limit stops attached to the moving part of the slide, and abutting at the end of their travel against a fixed part of the slide (adjustment of diameter, it should be noted, is effected by setting the cutting tool in its holder). It is clear that stops must be provided for each of the tools in use, and they must be brought into action in correct sequence. As it is not generally practicable or convenient to mount the stops directly adjacent to the individual tool-holders, so as to be indexed in position with them, it is usual to mount the stops in a separate indexing fitting, arranged for convenience at the rear end of the slide. This could be made independent of the capstan head, and indexed separately by the operator each time the head is moved, but this clearly involves the possibility of errors which might have serious consequences, and it is thus usual to gear the stop-holder to the capstan head, to correlate the two positively, and eliminate the risk of them getting out of step. (The mechanism by means of which this is effected is fully described in the handbook, "Capstan and Turret Lathes.")

None of the capstan attachments which have come to the notice of the writer so far have been equipped with any form of limit-stop gear, and in this respect the provision of this equipment on the attachment shown here may be regarded as an innovation; but no particular credit is claimed for it, as it is simply an adaptation of methods which are practically standard practice in capstan lathes. The gear is, however, arranged in the simplest possible manner, and presents no additional difficulties in construction, apart from necessitating a few extra parts.

Repetition Work on Small Lathes

Incidentally, it may be mentioned that the opinion has frequently been expressed, by persons of some considerable experience, that the average small lathe is inherently unsuited to carrying out repetition work, by reason of its light construction and lack of stamina. This is quite true, if one considers the question in terms of the outputs normally attained by small capstan lathes of modern design. The lathes we are considering are incapable of running at the high speeds and taking the heavy cuts for which modern repetition lathes are designed, but that does not mean to say that it is not practicable to do anything at all to increase their rate of output. With the aid of a capstan attachment, and without increasing the speed or rate of actual cutting to any great extent, it is often found that parts can be produced in anything from one-fifth to one-tenth the time taken in "individual" machining. In many cases, this is quite sufficient to justify the time and trouble taken in the construction of such an attachment. During the last Great War, when capstan lathes were very scarce, many old lathes of very poor mechanical design were pressed into service and converted into capstan lathes, and despite their limitations, they enabled the production of several factories to be multiplied many times. It may be remarked that the impression that small lathes are not suitable for repetition work may in many cases have been produced by experience with flimsy and inefficient capstan attachments.

Some Notes on the Design

It will be seen that the capstan attachment illustrated in Figs. 1 and 2 consists of a rotating capstan head pivoted on a "post" mounted on a flat soleplate, which moves longitudinally on slide bars in a frame clamped to the lathe bed, in the position normally occupied by the tailstock. The slide is actuated by means of a lever, having an adjustable link, which may be set for convenient operation over the required range of travel. The full range of movement is $3\frac{1}{2}$ in., which will rarely be required in the class of work for which such an attachment is expected to be used. It is hardly practicable to increase the length of travel with the slide frame shown, which is arranged to suit the normal size of 3-in. lathe having a short bed, admitting 12 in. between centres. The long bed lathes would allow of using a longer slide frame, but in this case it would be advisable to use larger diameter slide bars, in order to maintain the same degree of rigidity. If a wide range of travel is desired, it is advisable to arrange the lever for variable throw, by providing a range of pivot holes in it, like those in the link.

Slide Bars

The use of slide bars may be criticised by some readers, as being inferior to the vee slides usually fitted to machine tools. It is true that a properly-fitted vee slide gives the maximum possible bearing surface and rigidity, but it also involves considerably more work, and presents some almost insuperable machining problems to the amateur with limited equipment. Bar slides are often condemned out of hand, on the strength of the thoroughly bad examples of them which have appeared on some of the "cheap and nasty" machine tools produced in the past. But it is almost certain that their vices were due more to bad workmanship than inherent faults in design, and it is doubtful whether vee slides would have been any better if they had been as badly made. A properly made and fitted bar slide will give quite good results, and it may be observed that they are used in some of the most modern machine tools, including milling machines, in which badly-fitting or flimsy slides cannot be tolerated. The methods which will be described for constructing the slide in this case will ensure correct fit and smooth operation.

Stop Indexing Gear

The capstan head is arranged to index by hand in the usual way, and is locked in position at each tool station by a spring pin attached to a readily accessible lever. It is geared to the stop shaft by a very elementary form of toothed gearing which is neither a bevel or a spur gear, or yet any other classified type of gearing—but it does the job! The "teeth" in the underside of the capstan head are formed by a number of holes spaced equidistantly on a circle concentric with the axis of the bore, and they mesh with a thin-toothed wheel similar to a chain sprocket, on the stop shaft. This shaft runs in two bearings on the underside of the capstan slide, and passes out through the stationary slide frame crosspiece, beyond which it is fitted with an adjustable disc, drilled and tapped to take the six stop screws.

Either a round or hexagonal capstan head may be employed, the latter being preferable, as it enables tools, steadies or other fittings, to be bolted to the flat faces, in cases where this is better or more convenient than fitting them to the sockets. The number of stations provided in a hexagonal capstan is sufficient for most ordinary purposes, provided that the possibility of using one or more cross-slide tools is also considered.

(To be continued)

Clean Hands

Acetone is useful for cleaning the hands after using a paint-brush, as it will remove paint, varnish, shellac, enamel, lacquer and stain.—W. F. COMERFORD.

I Take a Chance . . .

The Experience of an Amateur Who Turned Professional

By " Turner "

I HAVE always agreed with Carlyle's opinion that men are mostly fools. I also have a private opinion, probably erroneous, that I am, at least, no bigger fool than the rest. The following account which is true in every particular, of how I, a raw model engineer, " gatecrashed " into the toolroom of one of the largest firms in the country, will probably be condemned by many as an outstanding example of " false pretences." On the other hand, many will agree that the end has justified the means. In any case, most will, I think, find my experiences amusing.

By profession I am a commercial traveller, having been employed for fifteen years by a firm which might be considered to be remotely connected with the engineering trade. On the outbreak of war my job was gone. However, I have always been a keen model engineer, and in a friendly consultation with my boss, I disclosed my plans for turning my engineering experiences to professional use. I had, from time to time, done small turning jobs at home for my firm, and my employer agreed that a reference alluding to " a good knowledge of light engineering and turning " presented no difficulties. Armed with this, I duly registered at the local labour exchange as a tool-room turner, obtained my card, and was sent for an interview to a large engineering works in the vicinity. During the short bus journey my feelings were very mixed, but taking my courage in both hands—although it would have gone into one hand quite easily—I comforted myself with the thought that the worst that could befall me was that I should speedily get the sack, and my venture and trepidations be at an end.

Joining the queue at the works gate, I slowly made my way to the employment office, where a keen-eyed young personnel manager sorted the chaff from the grain. I presented my employment card, tactfully answered a few questions, and was, to my great satisfaction, classified as grain. Thought I, my troubles are only just begun.

Now, I was shepherded into another building containing several rows of desks, upon which were a number of forms, one of which I was asked to complete. Age? Married or Single? Last occupation? Well, we will draw a veil over my answer to that question, it being sufficient to say that I did not depart much more than a mile from the truth. I do not attempt to justify the matter. Like many hundreds of model engineers I felt that I was capable of doing useful work, but that I was being debarred by traditional questions and formalities. Time seems to have proved that I was correct.

In another room I took my place at the end of a row of applicants sitting upon a long bench. At intervals a door in the end of the room opened, and the nearest applicant was beckoned in. Thus, my turn got nearer and nearer, until I was the next on the list. By this time I was very nervous—but so was everybody else. Well, now for it; I am beckoned in; I find myself seated before another personnel manager, and I am being questioned by a square-faced man with the jaw of a bulldog, who, though I did not know it at the time, was to be my foreman, and who was one of the mildest-mannered men whom I have ever met. So I am engaged; I am to start to-morrow; and I hasten home to my wife with the news that I am a tool-room turner—at the full hourly rates of pay!

That evening I spent in sorting out my best tools. My one-inch Starrett micrometer; my two-inch Brown and Sharpe micrometer; my dividers, rule and calipers, and, that most cherished possession, my seven-inch vernier. And so, early to bed, for I am to start at 8 a.m. in the morning.

In years to come, when all details are forgotten, I shall remember myself standing and waiting until the charge-hand is disengaged, and looking over banks of milling machines in an endeavour to catch a glimpse of the lathes at the far end of the shop. One, the nearest, seems a formidable machine; all knobs and levers, and I wonder will mine be as fearsome. So, at last, the charge-hand is free, and I am conducted to my machine, amidst the curious glances of the other turners. Now it suddenly comes upon me that I have been one of the greatest of Carlyle's fools; I wish I were well out of it, but I can hear the charge-hand's voice as he shows me my machine, and I must attend. So are my greatest fears realised. My machine is, ironically enough, of German make, a " Karger " precision, $8\frac{1}{2}$ in. lathe, with geared headstock and a multitude of knobs and levers. How different from my old $3\frac{1}{2}$ in. Drummond! Truly, it is a beautiful machine; modern and streamlined in appearance. All speeds and feeds are obtained by settings of the various levers; all threads, both English and Metric, may be set up by the movement of yet another set of levers. There is an engraved chart on the machine showing, pictorially, the various lever settings, so I am less perturbed.

So much for the machine. Now I am being introduced to the turner next to me, with a curt: " This is Ben." He is an old man, over 70 years of age, who, but for the war, was due for retirement. Confidentally, the charge-hand tells me that "Old Ben" despises micrometers, but is a wizard with the calipers. Everything seems strange and unfamiliar, and I cannot dispel the feeling that I should not be there at all.

However, things have gone too far for withdrawal, and I dismiss as fantastic the fleeting idea that I might sham a faint and be carried out of the premises. So I am handed my first job. It appears that I am attached to the machine tool repair department of the toolroom; that is, I shall be making new parts for the machines in the factory as they break or wear out. My first job is a shaft from a milling machine. I size it up. Certainly a job for between centres. Good! I centre the ends of the material, find the driver plate, lathe centres and the carrier, and mount the job up. Next, I must grind the tool steel which I have been given. Fortunately, it is the square, Vanadium stuff which I have always used, and which is held in a special tool holder. No difficulty there. So I proceed.

I speedily discover that the lathe is as good to work as it is to look at. How beautifully run the slides! How smooth is the clutch! Just a touch of the lever. Forward! Stop! Reverse! Accuracy and precision in every movement. Here is a revelation!

Old Ben sides up to me. " Well, how are you going on? "

I reply that I am O.K., but that the lathe is a little strange to me.

" You'll soon get used to that," says Ben. Then, in a lower voice: " What did he say to you? "

I gather that he means the charge-hand, so I quickly size the situation, and decide that a little tact will be helpful.

" Oh," I say, " he just explained the machine to me, and gave me the pattern for this job."

" Did he say anything about me? " says Ben.

I say: " Well, as a matter of fact, he did. He said that you were one of the good old school, and that you were the sort of chap to learn a thing or two from."

I saw old Ben swell visibly. " He did, did he? " And I know that I have made a friend for life.

So I again proceed. The bar of steel is roughed out

I check the job with the "mike," to see that the lathe is cutting parallel. All O.K. The shaft has three diameters, a collar near one end, and a threaded portion in the centre to take a screwed ring. I have been given the ring to fit to the job. It must be a good fit on the thread, with no "rock." Mentally I resolve that I will make no "junk." I will concentrate on quality rather than on quantity. Slowness will be attributed to a strange machine and tools, but inaccuracy will indicate inefficiency. At this point I nearly have a slip-up. In bending over the lathe my smock catches the handle of the cross-slide, and the tool digs into the job. I get a little hot, but, fortunately there is plenty of metal left on, as I am still in the roughing out stage. (Another mental note: I must wear a belt.)

Old Ben is fond of a chat. He has a curious habit of placing his head close to mine, and saying the most commonplace things as if he were imparting a state secret. He is still thinking of my remarks. He says: "So he thinks a lot of me, does he?" and walks away again. I am glad that I have given him food for this satisfaction.

Now I am on the finishing cut. My micrometer has been used frequently, and I have determined that the index on the cross slide is dead accurate. It will, positively, advance the tool by one thousandth of an inch. The screwcutting calls for care. I have placed the levers so that the spindle is turning at its slowest speed—37 turns per minute. Meanwhile, I have been watching a turner at the back of me cutting a thread, and I note that it is the practice not to disengage the clasp nut for the return of the tool. The tool is quickly withdrawn at the end of the cut, the reverse lever pulled over, and the whole carriage run backwards to the start. It is not very difficult at slow speed; and the job is finished. It is a good job. "Spot-on," as they say in the tool room.

As I hand the finished shaft to the charge-hand I try not to betray my feelings of anxiety and pride. He inspects it, and takes a measurement or two with his micrometer. I am not afraid, because I know that they are correct. He says:

"Oh, well! We'll work it in somehow." But I notice that there is a twinkle in his eye. This phrase is always used no matter what job is handed in. There is never any praise; even if the job is a masterpiece of craftsmanship it will always be "worked in somehow."

By now it is lunch time, or "dinner time" as it is always called. I must forget my nonsensical, middle-class phrases. We have a splendid canteen at the works, where a variety of dinners, including roast pheasant, may be had for a shilling. I pick up a tray, and walk past a long counter upon which are plates and plates of various dishes. I select my choice, and pay at the end of the counter—one shilling and a penny!

As I sit down at a table I notice that the fellow in front of me is vaguely familiar. I remember that he sat next to me in the interview room yesterday. "Hullo! How goes it?"

He is an unskilled man, and has a job as a labourer. He wears blue dungarees, whereas we of the tool room wear snow-white smocks which must be changed every two days. We are the aristocracy.

Ours is an "ideal factory," with lawns and gardens in country surroundings. There is still half an hour left to me before I resume work, so I stretch out on the grass in the sun, for it is a fine Autumn day, near a group of other white-clad figures. They are some of my workmates, and I strike up a conversation. The talk is restrained as between strangers, but I learn, among other things, that the time taken on a job is of less importance than its accuracy

My job after dinner is to wind a spring for the plunger of some machine. It must be 12 in. long, with a diameter of $\frac{3}{4}$ in. It must have four turns to the inch and be of 16 G. steel wire. For the moment I am stumped. I have wound light springs by hand upon my own lathe, but I realise that something different is called for here. But I must not let on that I do not know. Evidently there is some appliance with which I am not familiar. So to Old Ben I say:

"I've got this spring to wind, Ben. Can you lend me a 'doings' for the job?" Artfully, I conceal my ignorance of the name of the tool required. Old Ben is only too anxious to oblige. Instantly he produces a bar of steel from his drawer. It is about 12 in. long; of 1 in. by $\frac{3}{4}$ in. rectangular section. One end is bent almost at a right-angle, and there is a hole in this bent portion. Immediately I grasp its use. It is to be clamped in the tool post, and the ire fed through the hole. Ben says:

"What is the diameter of the spring and the gauge of the wire?"

I tell him. He says:

"Well, you'll want a mandrel $\frac{3}{4}$ in. diameter, less the gauge of the wire, to allow for the spring of the wire itself. I think I have got one here." He produces a bar of silver-steel, $\frac{5}{8}$ in. in diameter, and centred at the ends. One end of the bar has a hole in it to anchor the end of the wire.

"Now set your lathe up to four threads per inch," says Ben, "and away you go." He adds: "But be careful. If the wire breaks it will have your eye out!"

Here is something I have learned. In winding a spring it is anticipated that the finished job will expand at least twice the gauge of the wire when it is removed from the mandrel. Thus a mandrel is selected which is twice the gauge of the wire less in diameter than the required spring. I inspect the mandrel and winding bar, and resolve to make some of my own.

The charge-hand now approaches me with some pieces of tool steel, in rod of various sizes, and also in rectangular sections. I can spend the remainder of the afternoon in making for myself some turning tools. The round rod is for boring tools, which are held in a long Vee block in the tool post. The rectangular steel is for knife tools. These latter are greatly used for roughing-out; they have very little side and front rake, but a very pronounced top rake. Huge cuts may be taken with them, and I have seen shavings removed of at least $\frac{3}{4}$ in. in width. Slow speed and heavy cuts are the secrets of roughing out, with plenty of "suds" to keep the tool edge cool.

So ended my first day. I had been able to do all that I had been asked. My jobs were successful, and evidently up to standard. The fact that I had been asked to make up my kit of turning tools showed me that I was, at least, not a dismal failure.

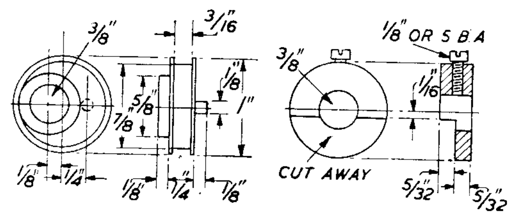
During that first day as a professional turner, I was struck by two things. The first of these was that many model engineers have nothing to fear in a comparison of their work with professional efforts. I have never considered myself as being exceptionally good on a lathe, and there are many of my model-making friends who are streets ahead of me in this class of work. The second point was the difference between amateur and professional equipment. It is chiefly a difference in size. Professional equipment is *big*. It is robust. It is heavy. Many tools are forged from bars of high-speed steel of $1\frac{1}{2}$ in. by $\frac{3}{4}$ in. in section. Compare this with the usual amateur tools of $\frac{1}{4}$ in. or 5/16 in. square section. And the jobs which are done are often no larger. This sheer mass or weight of equipment is rather frightening to the amateur at first, but it is one of the secrets of good work. Large, professional lathes are much easier to operate than the small machines which amateurs can afford. My "Karger" lathe cost almost £700.

(To be concluded)

"RAINHILL," A $3\frac{1}{2}$ in. Gauge "Rocket" type Passenger-hauler

By "L.B.S.C."

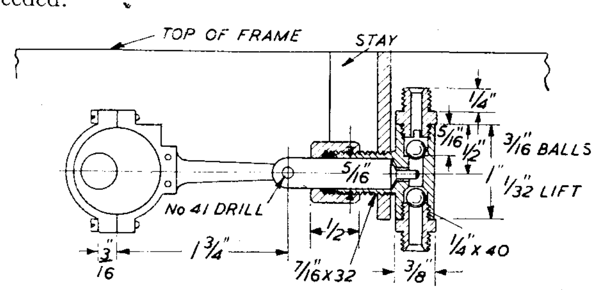
THE eccentrics must be mounted on the driving axle before pressing on the second wheel. Three eccentrics and two stop collars are needed, if the feed pump is to be fitted. All eccentric sheaves or tumblers are turned from 1 in. round mild steel rod. If your chuck will not hold it, mount the length between centres, turn all three sheaves, and part down to within about 3/16 in. of centre. Then saw them off, and finish off in the three jaw. The sheaves for the valve-gear eccentrics are shown in the detail sketch; note that a boss, $\frac{5}{8}$ in. diameter and $\frac{1}{8}$ in. thickness, is left on the side opposite to the stop pin, to act as a distance piece for preventing the eccentric hitting the lugs on the bottom of the hornblocks. Aim for the best possible



Eccentric and stop collar.

finish in the grooves, or the straps will soon be what is popularly known as "chewed up."

The stop collars can be turned from 1 in. brass or steel rod. Note that the piece cut away is less than half the diameter. This, plus the $\frac{1}{8}$ in. stop pins in the sheaves, will give the valves sufficient advance to make the old iron scoot like a startled deer, with a degree of liveliness that was never seen or experienced by her big sisters on the old Liverpool and Manchester line. The pump eccentric is pretty much the same as those for the valves, but the boss should be $\frac{1}{4}$ in. wide and fitted with a setscrew; also, the axle hole is drilled 3/16 in. out of centre, for $\frac{3}{8}$ in. stroke of pump. No stop pin is needed.

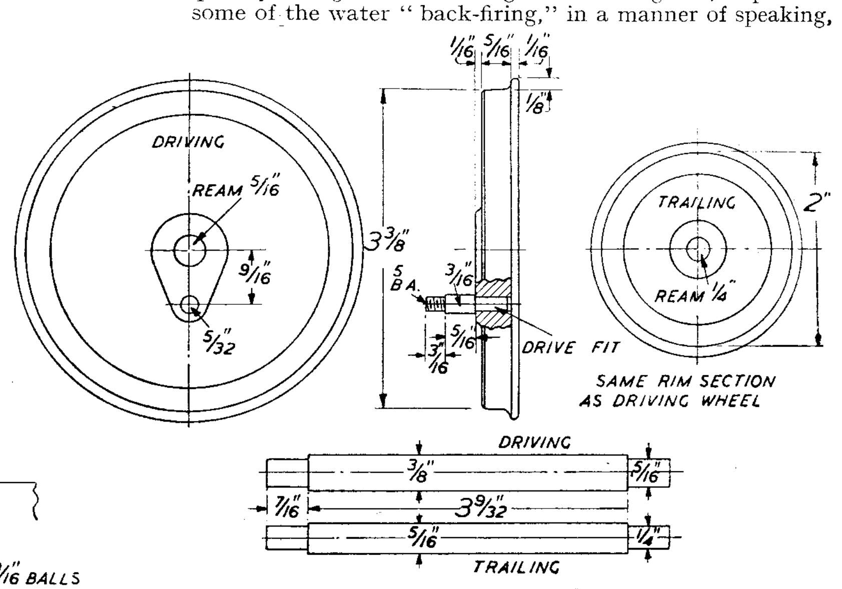


Feed pump.

To assemble, take the axle, which already has one driving wheel pressed on it. First, put the axlebox on the axle, flange first; then one of the valve eccentrics, boss first; then a stop collar, with the cut-away side next to the eccentric; then the pump eccentric, boss first; then the second stop collar, plain side first; then the second valve eccentric, pin next to stop collar; finally the other axlebox, flange outwards. The second driving wheel can then be pressed on, taking care to get the crank-pin holes at right-angles, as per instructions in previous notes on other engines. It does not matter which side leads. The crankpins can then be turned up from 3/16 in. round silver-steel, as per sketch, and pressed into the holes in the wheel bosses; and the whole doings, complete with blobs and gadgets, can then be erected in the frames, and the hornstays, springs, spring plates and nuts put on. The wheels should spin freely, with the axleboxes in the middle of the frame slots.

Feed Pump

This is the same as I have described in full, umpteen times over, for $2\frac{1}{2}$ in. gauge locomotives, and is plenty big enough to supply all the needs of the little boiler going all out, and still have a drop to spare. All the dimensions necessary are given on the drawing. Don't forget that if the balls have more than 1/32 in. lift, they will not seat quickly enough, when the engine is running fast, to prevent some of the water "back-firing," in a manner of speaking,



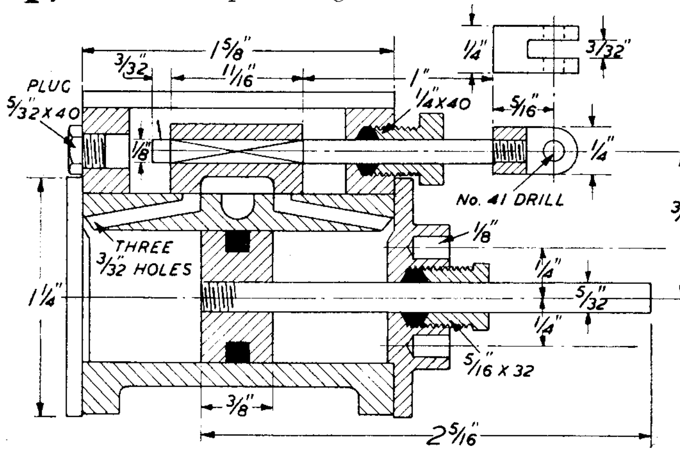
Wheels and axles.

and so reducing the amount delivered to the boiler. Leaving out the anti-airlock pin also reduces delivery. Some of our advertisers can still supply castings for this type of pump. Rustless steel is the best material to use for the ram or plunger; failing that, phosphor-bronze, the hard-drawn variety which needs no turning. For novices' benefit I will repeat assembly instructions, as they are important. Screw the pump barrel through the stay, insert ram, and pack gland with graphited yarn. Erect the assembly between frames, stay flanges toward front of engine. Turn up eccentric strap and fit a 3/32 in. flat rod to it. Fit strap to tumbler so that it works freely, and does not act as a brake. Push pump ram right home; place eccentric on back dead centre, nearest to pump, and enter the end of the eccentric rod into the slot in the ram. With

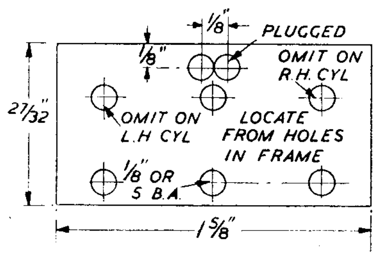
a bent scriber poked through the wrist-pin hole, make a mark on the eccentric rod. Remove rod, *and centre-pop it 1/32 in. nearer the strap than indicated by the mark.* Drill a No. 41 hole at the pop, caseharden the end, and refit, putting a pin, made from 3/32 in. silver steel or 13 gauge spoke wire, through the lot, nutting it at both ends. Alternatively, the hole in the rod may be drilled 5/32 in., and bronze-bushed.

Cylinders

To be in keeping with the rest of the "ancient and honourable," the cylinders should be of the stationary-engine type with small steam chests; but we want her to have as much kick as possible, and a good turn of speed, plus economical working, so I have specified a modern type of cylinder, with "period" guide bars, crossheads and connecting rods, "to keep up appearance" as you might say. Something like Anna Neagle made up as Queen Victoria. On these old buses, the centre line of cylinder bores did not correspond with the centre of the connecting-rod, which was tacked on as a sort of afterthought on the outside of the crosshead; incidentally, I expect that was where the makers of some of the alleged locomotives illustrated in the "Leek" and other old-time catalogues got their ideas! However, that makes no odds, as we can use cylinder castings as sold for the "Dyak," and other $2\frac{1}{2}$ in. gauge locomotives which I have described in full. It only means machining off a bigger chunk of the bolting face, and bringing the cylinder-bore centre-line to within 15/32 in. of the frames, instead of the usual 13/16 in. The machining of the cylinder blocks is carried out exactly the same as I described when dealing with the engines mentioned.

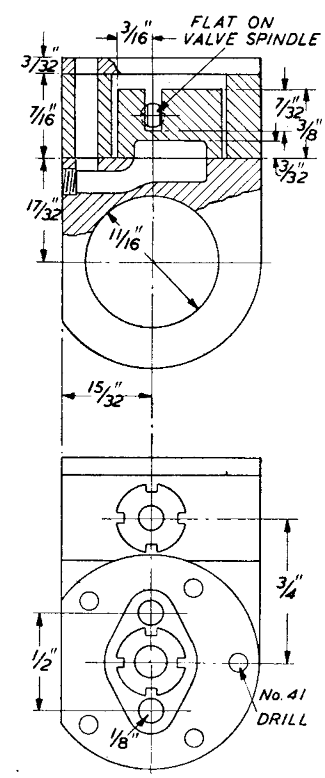


Cylinders for *Rainhill*.



Cylinder bolting face.

The ports, though shorter than I usually specify for cylinders of similar bore and stroke, are as big as the steam chest will permit. The connection between port and bore is made by three 3/32 in. holes, as usual (see sectional sketch) but the exhaust "entrance to the way out" is different, inasmuch as it goes out by an upstairs route through the wall of the steam chest, instead of via the back door as usually arranged. It was my intention at first to bring it out through the front end of the cylinder, by a longitudinal passageway drilled between the bore and the bolting face; but when I got down to details and visualised the finished cylinder, I saw that we would be in for trouble with the fixing screws in the bolting face, the front cylinder cover, and a flange connection that would be awkward to get at. It was, of course, impossible to work the usual stunt, as the firebox effectually blocked the rear exit, and the only alternative was to take the exhaust through the top, a wheeze I have worked several times, e.g., on the outside cylinders of my four-cylinder 4-12-2 which has all four cylinders in line. Instead of the usual one $\frac{1}{4}$ in. hole drilled from the bolting face into the exhaust port, two $\frac{1}{8}$ in. holes are drilled side by side, as shown in the cross-section sketch, and the ends tapped and plugged. Tip—don't drill the vertical connections until the cover and steam chest are made and fitted; then drill the lot at one fell swoop. By this means you ensure that all the holes are in line, and the exhaust has a clear way out, with no ledges or other obstructions to check it.



Covers and Steam Chest

The back cover is the usual plain disc with a register on it to fit the bore. The front cover is also very much the same as usual, except that the guide-bar holes are plain, and not tapped, and are only $\frac{1}{2}$ in. between centres. Both covers are attached by five 3/32 in. or 7 B.A. screws in each. As to the steam chest, I find on measuring up the stock "Dyak," etc., castings, that the steam chests for these have a central opening approximately $\frac{7}{8}$ in. wide and $1\frac{1}{8}$ in. long. As the inside measurement of the steam chest for *Rainhill's* cylinders is only 19/32 in., the front wall of the steam chest casting should be sawn off, the side walls shortened about 5/16 in. or so, and the front wall refixed by silver-soldering. The attenuated casting can then be machined, as fully described in previous notes, to the dimensions given on the sketches, and the screwholes drilled.

The steam chest cover is a piece of 3/32 in. sheet brass $1\frac{5}{8}$ in. long and 1 1/32 in. wide. Clamp it to the steam chest and drill the screwholes; then clamp the steam chest to the cylinder, mark the location of the screwholes through those in the steam chest, remove, drill the larger

ones No. 44, and tap them 6 B.A. The two smaller ones in the outer edge are drilled No. 53 and tapped 9 B.A. Temporarily assemble the lot; then mark off on the top cover the position of the vertical exhaust holes, taking your measurement from the sketch of steam chest, and drill the two 1/8 in. holes through cover, steam-chest wall, and cylinder block right down into the horizontal holes in the block. Don't forget to smooth off any burrs when you take the pieces apart again.

Pistons and Valves

Piston-rods are 5/32 in. rustless steel, 2 5/16 in. long, with 3/16 in. of 40-pitch thread on one end. The pistons are turned from drawn bronze rod, or from cast stick obtained by melting down an aluminium-alloy automobile engine piston. Leave them 1/64 in. oversize, fit on rods by the "precision-chuck" method described in connection with other engines in this series, and then chuck truly by the rods, either in a collet, or a split bush in three-jaw. Finish-turn the pistons so that they will just slide easily in the bores. The grooves are 1/8 in. wide and deep, and packed with graphited yarn.

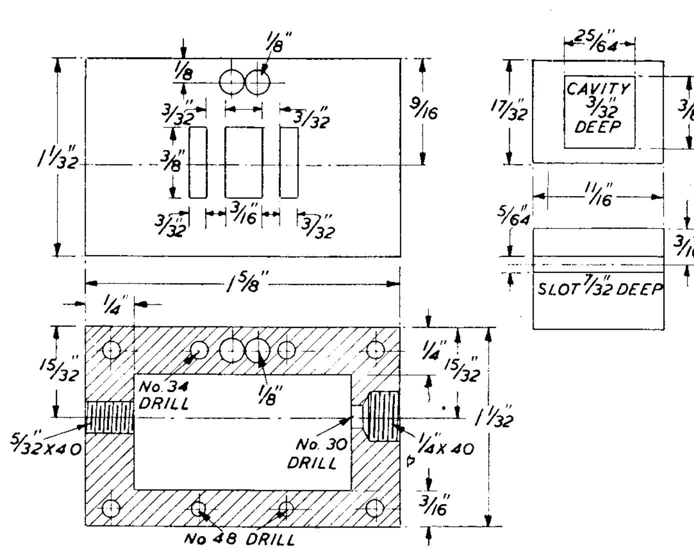
The slide valves are blocks of bronze, rustless steel, or piston metal, 11/16 in. long, 17/32 in. wide, and 3/8 in. thickness. Separate sketches are given, showing the back, with the groove for valve spindle in it; and the working face, showing the exhaust cavity, the dimensions of which should be closely followed. The longitudinal and cross sections give the other measurements, and are shown in the sketches of the corresponding sections of the cylinder. The drive for the valve is by the old-fashioned flat-and-slot device, which wants some beating even yet, for simplicity and reliability. The valve spindles are 2 in. lengths of 1/8 in. rustless steel or bronze rod. At 3/32 in. from one end, file a flat on either side, which will allow the spindle to drop easily into the slot in the back of the valve without permitting any end-play. The outer end is screwed 5 B.A., and furnished with a little fork or clevis, made from 1/4 in. square steel, and slotted to take a 3/32 in. valve rod for connecting up to the rocking lever, as shown in general arrangement drawing. The glands are turned up from 3/8 in. round rod. I have shown the usual heads with C-spanner slots, but they can have hexagon or square heads, or unslotted knurled heads, whichever you prefer.

Be Very Careful

Before assembling the cylinders "for keeps," see that you get a perfectly flat true surface on both port faces and valves, by rubbing them on a sheet of very fine emery cloth or other abrasive, laid on the lathe bed or something equally flat and true. Assemble with thin oiled paper gaskets in all contact joints, and pack the glands with graphited yarn. In such a condensed description of the engine, it is impossible to include full machining and fitting details; but if any novice, tyro or inexperienced worker gets into a jam, and has not the back numbers containing the necessary "words and music," I will be pleased to elaborate a little.

Blame the Wretched Oil!

Just recently there has been a flood of complaints about oil burners on engines using liquid fuel failing to perform their allotted task. In one week alone, three friends on the "green light" list sent their oil burners to me for examination and report! Well, it is no fault of the burners, but the stuff at present available for use in them, that is the cause of all the trouble. I had a burner which had given complete satisfaction for years, give up the ghost entirely when the container was filled with some



Portface, valve and steam chest.

freshly-purchased alleged paraffin; and on examination, found the space behind the nipple completely choked by a solid block of carbon. The burners of the three friends mentioned above, all suffered from carbon deposit. Where gauzes were fitted behind the nipples, these were blocked, too, and had to be renewed.

Until the quality of the fuel improves, the only thing to do is use petrol, where obtainable, or a mixture of paraffin and petrol, adjusting the air supply either by sliding the mixing tube in or out on a Carson-type burner, or putting a bush in the end of the axle-dodger type, which passes the necessary quantity of air. Where the small quantity of petrol needed cannot be obtained, and paraffin must be used, the only thing to do is to roll up a tiny bit of fine gauze and put it in the recess in the back of the nipple, which should be drilled out to 1/8 in., and change it when the engine has had, say, two runs of an hour each. It is curious, but *per contra* to the above, that the last delivery of Welsh nuts for our domestic boiler seems better than ever, and gives splendid results on the little locomotives with correct-pattern boilers. Give me the good old coal burner every time!

A Steel-blueing Recipe

That blue of certain razor blades can easily be reproduced on small steel tools by the following process, which consists of exposing the article (which must be free from rust) to a definite temperature that favours the formation of this particular blue-coloured iron oxide. This is accomplished by immersing the article in molten potassium nitrate or sodium nitrate.

The chemical can be melted in a small tin over a Bunsen burner. The flame is then lowered and the article immersed. This will chill the molten chemical and form a crystal covering on the metal, but increasing the heat slightly will cause this coating to melt. Too high a temperature is not desirable. If the chemical is kept just molten this automatically controls the temperature. The work is allowed to remain for a minute and is then removed and cooled.—L. A. WATSON.

Making a Dome Cover

By A. J. T. Eyles

THE writer read with much interest the article by "L.B.S.C" entitled "Built-up Boiler Mountings," in the February 6th issue; having had considerable experience in making sheet metal dome covers, he thinks a few further notes may be of interest.

In the article referred to it is stated "A dome, for example, would consist of three pieces, the rounded top, the sides or barrel, and the base." This fabrication method is shown in the sketch on page 108 with serrated joints. While employed in the coppersmith's shop at the Great Western Railway Works, Swindon, a few decades ago it was our practice to make all locomotive dome covers from sheet brass in two pieces with dove-tailed brazed joints as shown in Fig. 1, and, when making model dome covers the two-piece method has always been practised whether made from sheet brass, copper or steel. In the process of making a dovetail, thinned-edge joint, the edges of both pieces of metal are thinned by hammering while it is resting on an iron or steel tool (the edges, of course, can also be thinned by filing), but only one edge is cut, as shown at A in Fig. 2, to form the necessary cramps. Cutting is usually done by a sharp chisel or a knife held at an angle, for fairly large size dome covers, but tinsmith's snips are more suitable for cutting the cramps for most model dome covers. This method of cutting ensures that when the cramps are hammered down there will be no thick edges at their sides, and that the brazed or silver-soldered joint can be made perfectly flush and of the same thickness as the surrounding surfaces. For the joint on the circular body, the cramps are bent up right and left alternately to allow the thinned portion of the other edge to go in as far as possible between them, and so that alternate cramps go on opposite faces of the thinned edge. When the edges are fitted together, the job is usually bound with thin iron wire, twisted tightly, so

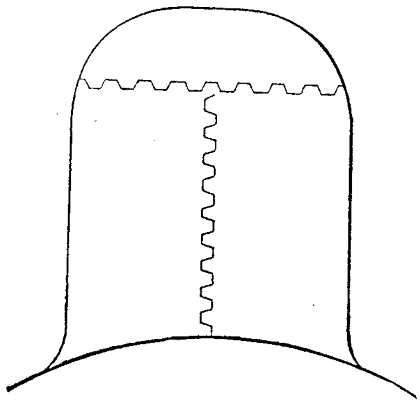


Fig. 1. Dovetail brazed joints on sheet metal dome cover.

as to keep this joint securely in position during the brazing operation. The cramps are closed down with a mallet or hammer, over an iron stake or mandrel.

In brazing a side joint on a dome cover of fairly large dimensions, care should be taken not to allow the brazing alloy to flow away from the joint. To avoid this, the brazing alloy should be placed solely along the joint. In railroad shop practice the method usually adopted to keep the brazing alloy to the joint, is to bend the dome body "pear-shape." The sharp radius thus made ensures the brazing metal running or flowing along the joint only. To keep the job in position during the brazing operation, it is advisable to fasten the centre portion with sheet metal clips or clamps. After brazing, shape the metal circular form.

With regard to making the convex shape dome cover top, a large size dome top is best made with a hollowing hammer in spherical depressions on a hardwood block, but for small size model dome covers, the punch and die method as suggested in the article is quite "O.K." In fitting the dome top, the cramps should be well closed down by hammering, as previously indicated. The circular joint should then be brazed, using a low melting point brazing metal. Powdered borax may be used as flux, but it is

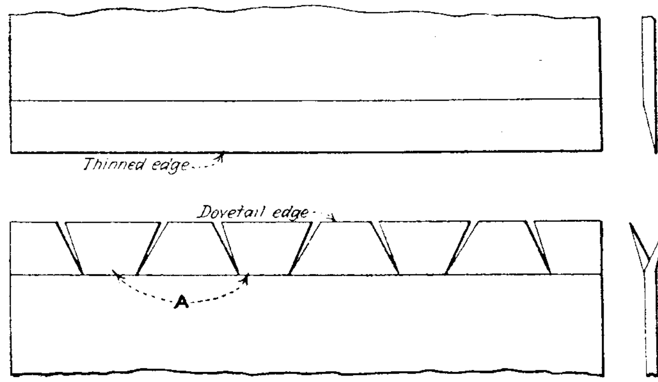


Fig. 2. Method of making a dovetail joint.

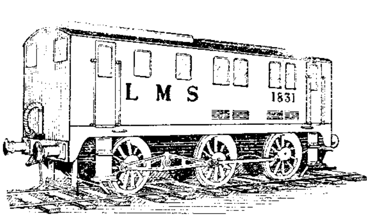
advisable to have it calcined (fused), since calcining prevents it from swelling and frothing, as well as carrying away the brazing metal when the heat is first applied. Calcining may be done by applying a bunsen flame from a blowpipe or blowlamp upon the borax, when it will swell up. It can be rubbed down after it has cooled. Borax treated in this way is much easier to use. An excellent proprietary flux to use in silver-brazing sheet brass dome covers is known as "Tenacity Flux No. 3. After the circular joint has been brazed, carefully clean it up by filing and polishing it, preferably by rotating it in a lathe or other suitable device.

For the Bookshelf

Flying Model Planes. By Harry McDougall (London: Lutterworth Press). Price 6s. 0d. net.

This book is a useful handbook for the novice to the pastime of building flying model aeroplanes. After a brief chapter dealing with the history of model aircraft, it proceeds to explain, fully and clearly, the principles underlying the successful flight of heavier-than-air machines. The author then describes a very simple design for a model, after which he goes carefully into the questions of construction, materials required, variations of detail, reasons for modifying certain features, and leads up to descriptions of two well-tried and successful designs of model aeroplanes.

There are 160 pages and 130 diagrams and drawings; in addition, a glossary of model aeronautical terms is included.



1831 . . .

★A $3\frac{1}{2}$-in. gauge I.C. Engine-driven Locomotive

By Edgar T. Westbury

Ball-Race Housings (Fig. 30)

In view of the fact that the jackshaft is driven through skew gearing, and is therefore subjected to fairly heavy end thrust, it has been considered desirable to run it in ball-bearings. The type recommended is Skefko EE3, though others of similar size and specification are suitable; this type is designed principally to deal with radial load, but will also withstand considerable end thrust quite satisfactorily, and has the further advantage, for this particular duty, of requiring no running attention for long periods. As they are situated in a somewhat inaccessible position, hidden behind the main frames, the chances of their being neglected in respect of lubrication are by no means improbable.

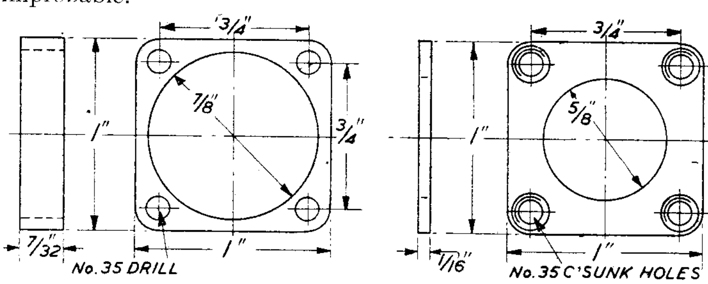


Fig. 30. Ball-race housings and cover plates (2 off each).

The housings are 1 in. square externally, and may be machined from brass or steel bar or plate. They are bored to take the races a tight push fit, and care should be taken to ensure that their end faces are perfectly parallel, and square with the bore. Although the dimension given on the drawing for the thickness of the housing is 7/32 in., one of the housings should be made at least 0.010 in. thicker than the race, so that the latter is free to float endwise when fitted. The amount of end clearance allowed might with advantage be much greater, except for the fact that the room between the main frames is limited, as shown in Fig. 27. The "located" ball-race should not be allowed any end play at all in its housing.

If the housings are made from 1 in. square bar, it will be possible to bore and part off both at one end setting, and then carry on with the cover plates, which are bored $\frac{5}{8}$ in. diameter and parted off 1/16 in. thick, neither of these dimensions being critical. One might go further with the "one-setting" idea by drilling the four fixing screw holes in the corners before setting up the bar in the lathe, thus saving a good deal of time in the essential operations.

In order to locate the housings accurately on the side plates, it is advisable to turn up a locating plug, having a spigot to fit the drilled hole in the plate, and a flange to fit the bore of the housing. This is put in position, and the screw holes "spotted" through the housing into the plate. It is very important that the register of the parts should be dead accurate when finally assembled, and thus the holes in the housing are made to fit the screws very closely. If desired, the housings may also be dowelled to ensure that they cannot be assembled out of place; or better still, they may be permanently sweated to the side plates. In the latter case, the locating plug may with advantage be made of aluminium, so that it can be left in position during the sweating operation, without any risk of it becoming itself sweated in.

After fitting the housings, the centre holes in the side plates may be opened out to $\frac{5}{8}$ in. dia., to provide clearance for the driving shaft. The sub-frame may then be assembled, and checked up for accuracy all ways. A square laid along either side of the frame should show the ends to be in true register; if laid crosswise on the frames, the top and bottom edges should be likewise; and the parallelism of the top surfaces of the plates should be verified by sighting across them. It is advisable to tighten the screws holding the cross members as securely as possible, as it would be difficult to get at them if they became slack after final assembly, except by dismantling the chassis.

Jackshaft

This component is turned from mild steel, to the dimensions shown in Fig. 31, by methods similar to those recommended for the main axles, and the same care should be observed in ensuring that all parts of it run quite truly. It is advisable to leave an extra length of not less than $\frac{1}{8}$ in. on each end, for reasons which will be apparent later, and in this case the centres should be drilled very deeply so that they will not be machined away when the shaft is finally faced off to the correct length. The length of the centre portion of the shaft should be about 0.005 in. greater than the actual width of the frame, to allow for the floating clearance in the ball-race housing on one side. The diameters should be kept closely to dimensions and parallelism, except that on the ends it is permissible to allow a very slight taper, not more than about 0.0005 in. in the 15/16 in. length; a slight fillet should be left at the shoulder. When finished, these ends should take the ball-races a light driving fit, and care should be taken to see that the races bed against the shoulders, and do not "ride" on the fillets.

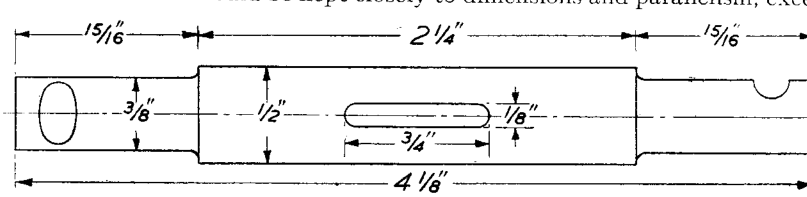


Fig. 31. Jackshaft (1 off).

The only other operation to be carried out on the jackshaft at the present stage is the cutting of the keyway for the skew gear. Most constructors will find it convenient to carry out this operation by end-milling in the lathe, the shaft being held crosswise in the tool post, and packed up to coincide exactly with the height of the lathe centres. If, however, it should be found more convenient to cut the

* *Continued from page* 251, "*M.E.*," *March* 27, 1941.

keyway with a side milling-cutter, such as a slotting or Woodruffe key-seating cutter, there is no objection to this, so long as the appropriate type of key is fitted. The exact length of the keyway, and its relation to the cross grooves which locate the cranks, are also unimportant.

Jackshaft Cranks (Fig. 32)

It is intended that iron castings should be provided for these, but they may be machined from mild steel without a great deal of difficulty, and this will in most cases result in a cleaner and stronger job. Readers may note that in the general arrangement blue print of the locomotive, the jackshaft crank is shown as a plain crank, without any

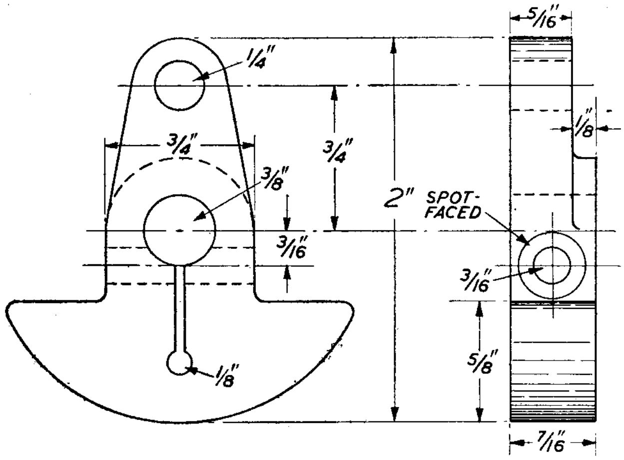


Fig. 32. Jackshaft crank (2 off).

balance-weights, and this corresponds with the published drawings of the prototype, which were the principal source of information for this design. It soon became apparent, however, that it would be very desirable to counterbalance the jackshaft crank, in view of the unavoidable weight of the connecting-rods ; and it has since been discovered that the same thing has actually been done in the prototype, but whether this feature existed in the original design, or has been added since, I am unable to ascertain. Anyhow, the fact remains that the balanced cranks are correct, both in respect of prototype practice and sound mechanical design.

The machining of the cranks is fairly simple and straightforward. They should first be chucked inside outwards, faced over the back, drilled exactly central and reamered to a light drive fit on the shaft. A stub mandrel, or a short, stiff mandrel between centres, should then be used to mount them for facing the front and turning the segment of the balance-weight. If they are being made from the solid, the sides of the web should next be cut to shape, and the web thinned at the back. The best way to do this is to mount the crank eccentrically on the faceplate or in the four-jaw chuck ; if a centre is marked out on the back of the balance-weight, 9/16 in. from the shaft centre, and this is set to run truly, it will be possible to machine away the maximum amount of metal here without fouling the balance-weight. The corners left on the boss may then be rounded off by filing, or by a circular milling operation ; but the partially-rounded boss produced by the turning operation looks quite neat, and may be left if desired (Fig. 33).

In order to bore the crankpin seatings, the cranks must be set up on the faceplate at exactly the same amount of eccentricity as the track wheels, and thus it is advisable to use the jig plate employed in the former case, and if possible, before shifting it from its set position on the faceplate. Unfortunately, I neglected to state that the jig would be required for this further purpose when describing the machining of the wheels, but if it has been dismounted, it is possible, by the exercise of care and patience, to re-set it within very fine limits of accuracy. In order to do this, one of the wheels, complete with its crankpin, should be attached to the jig-plate, with the throw centre line exactly in line with the bolting centres, as it was for its own boring operation ; the plate is then set up on the faceplate with the bolts only partially tightened, and adjusted by tapping gently until the crankpin runs quite truly. The use of some form of test indicator, such as the little " Kalper " dial gauge or the " Unique " indicator, will be very helpful for this operation, but even without these aids, it is possible to work to very close accuracy, so long as one does not grudge a little patience on the job. Many a turner has had to set up a job to " split thou's " with no further aid to precision than a bit of chalk !

Having centred the crankpin so that no wobble is perceptible, the jig-plate is then tightened up firmly on the faceplate, the wheel is removed, and the jackshaft crank

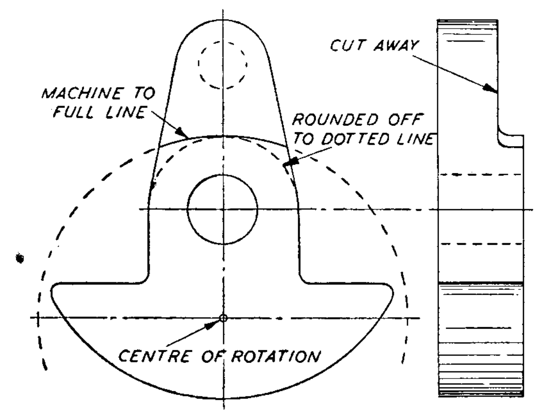


Fig. 33. Jackshaft crank set up for machining back of crank web.

put in its place for centring, drilling and reamering. Both cranks are, of course, treated in the same way.

The jackshaft crankpins are identical with those of the wheels except for being $\frac{1}{8}$ in. shorter, and are dealt with in exactly the same way. When they are pressed in, the taper pins in the collars should be set in such a plane as to coincide with those fitted to the wheel crankpins.

(To be continued)

Withdrawing a Tight Key

The overhaul or repair of machinery often necessitates the withdrawal of a key before a gear-wheel or pulley can be removed. Very often a tight key will defy the usual means of extraction, the head bending or breaking off.

The following idea has been employed successfully many times by welding a piece of round rod of suitable section to the head of the key by means of the oxy-acetylene blowpipe, the opposite end being screwed to take a nut and washer to receive the blow of the sliding weight.

In operation, the weight, which can be an old gear-wheel or piece of stock with suitable hole drilled, is slid smartly along the rod against the nut and washer, thereby exerting a heavy straight-pull. This repeated several times will shift the tightest key.

After removal, the rod is sawn off and the head of the key cleaned up before refitting.—H. W. ATTREE.

*RAILWAY SIGNALS

Standard Semaphore Types used in Pre-grouping Days

By O. S. Nock, B.Sc.,
A.M.I.Mech.E., M.I.R.S.E.

No. 15.—Great Eastern Railway

In discussing the semaphore signals of each of the pre-grouping companies, while describing the broad outline of the various designs, I have commented freely upon the many peculiarities of detail that distinguish the equipment of one railway from that of others. It might well be imagined, however, that on reaching the fifteenth article of the series, there would not be much left in the way of novel features to describe; but even a casual glance at the Great Eastern semaphore signal shown in Fig. 1 reveals several interesting points, and detailed consideration confirms the

* *Continued from page* 251, "*M.E.*," *March* 27, 1941.

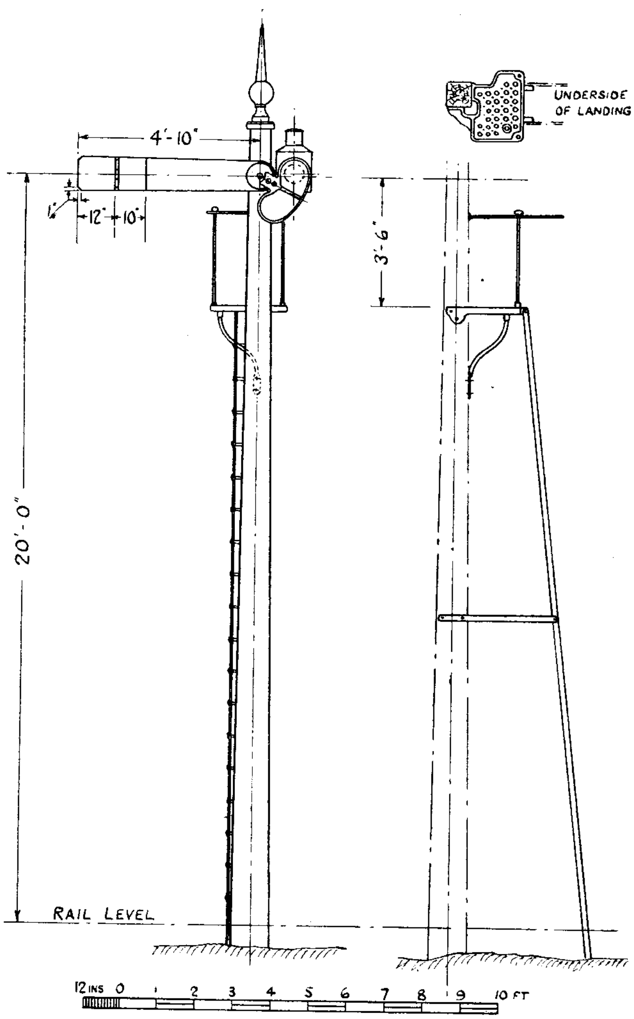


Fig. 1.

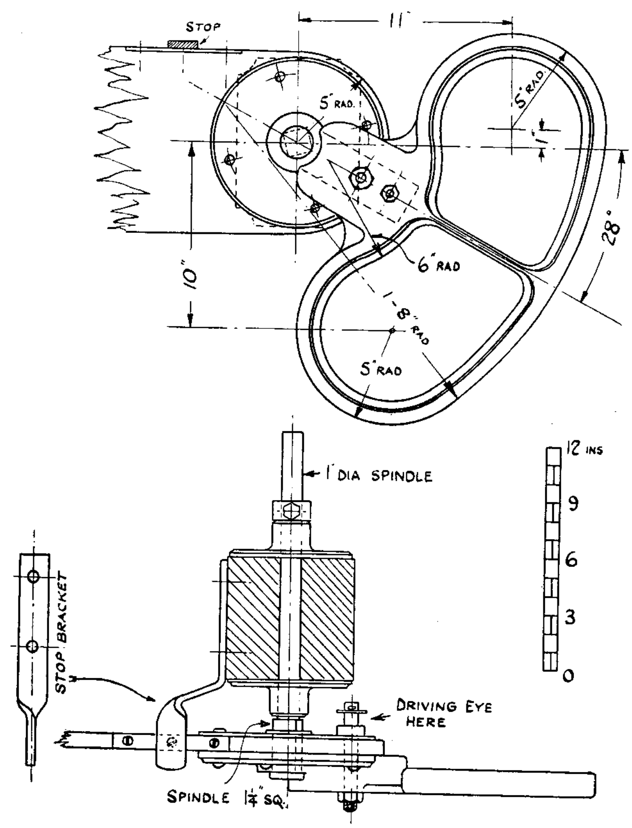


Fig. 2.

first impression. I should explain that on the Great Eastern, as on several other lines, the design of signal was changed in detail from time to time; the particular variety chosen for this article is that used in the complete resignalling of Liverpool Street Station some forty years ago.

The arm is chamfered at the tip. Its overall width at this point is 11 in. tapering down to 10 in. at the centre line of the pivot. Towards the outer end a strengthening band was used, of 1-in. × ⅛-in. iron, secured by copper rivets. One often sees such bands added to wooden semaphores that are showing a tendency to split, but the Great Eastern put them on when the arms were new. In the signal shown in Fig. 1 the band would, of course, be painted white. The arm-plate and spectacle need special consideration, but before leaving Fig. 1 there are some further interesting points to be noted. First of all, the pinnacle is made of wood throughout, in contrast to the practice of nearly every other company; then, conversely, while timber landing treads were almost universal elsewhere, the Great Eastern made theirs of cast-iron! The inverted plan view shows the general form of this landing, with holes to lessen the weight, and also shows clearly that the ladder is set out of centre with the post. The curving outer support for the landing is also an iron casting, the portion between the tab end that fits on the post, and the socket at the top being cruciform in section. The post itself tapers from 6½ in.

square at the top to 12 in. square at rail level, these dimensions applying to posts up to 40 ft. high.

Now we come to the very interesting arm-plate and spectacle shown in Fig. 2. The arm-plate is circular, with a raised tongue for fitting into a corresponding recess in the spectacle casting. The arm itself is secured to the plate by four $\frac{3}{8}$-in. dia. rivets, a 3/16-in. thick washer plate being fitted at the back. The arm plate is squared on to the spindle, though for some reason the square was set at an odd angle to the centre line of the arm. The stop, for the danger position of the arm, is faintly reminiscent of Midland practice, in that the top edge of the semaphore takes the blow; but the stop, instead of being part of the main spindle bearing, is a separate unit—an iron forging, screwed independently to the post. An iron pad, 6 in. long and made from a piece of $\frac{3}{4}$-in. $\times$ $\frac{1}{4}$-in. bar, is screwed to the arm so as to avoid the stop-piece striking the wood. The spectacle is a masterpiece of cussedness, for the various radii are struck from the most unlikely points! The outermost radius, 1 ft. 8 in. is struck from a point $4\frac{1}{2}$ in. *beyond* the centre line of the arm spindle, while the inner radius of 6 in., is from a point considerably short of the centre.

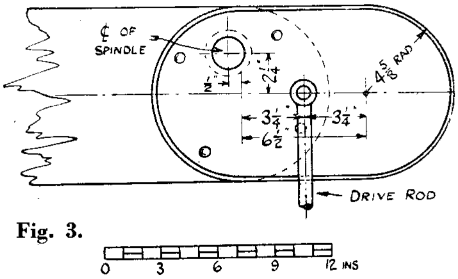


Fig. 3.

In addition to the standard main-line arm, as shown in Figs. 1 and 2, there were many localities in which the lamp was placed below the arm, and then, to provide the necessary counterweighting effect, an elongated arm plate, as shown in Fig. 3 was used; this arm was pivoted off centre, again to obtain the greatest return effect from the counterweight. The spectacle, used lower down the post, was generally similar to that shown in Fig. 2, save that the casting wa extended to include a boss for the spindle; this spindle was a round bar throughout its length, and the spectacle casting was secured by a set-screw. Another interesting subsidiary semaphore used by the Great Eastern was the fog-repeater arm shown in Fig. 4; this was fixed at the foot of the main-line signal posts and co-acted with the main arm, thus acting as a guide both to drivers and to the fogmen. Writing of co-actors recalls the practice, used in many localities on the Great Eastern, where sighting was awkward, of having two full-sized signals co-acting. There might be, for example, a distant signal in a curving cutting; one post would be located at the side of the line in the usual place, and the co-acting signal would be perched exactly abreast, but right at the top of the bank and on a very tall post at that.

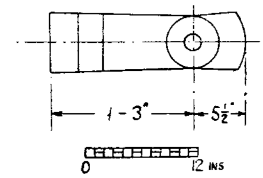
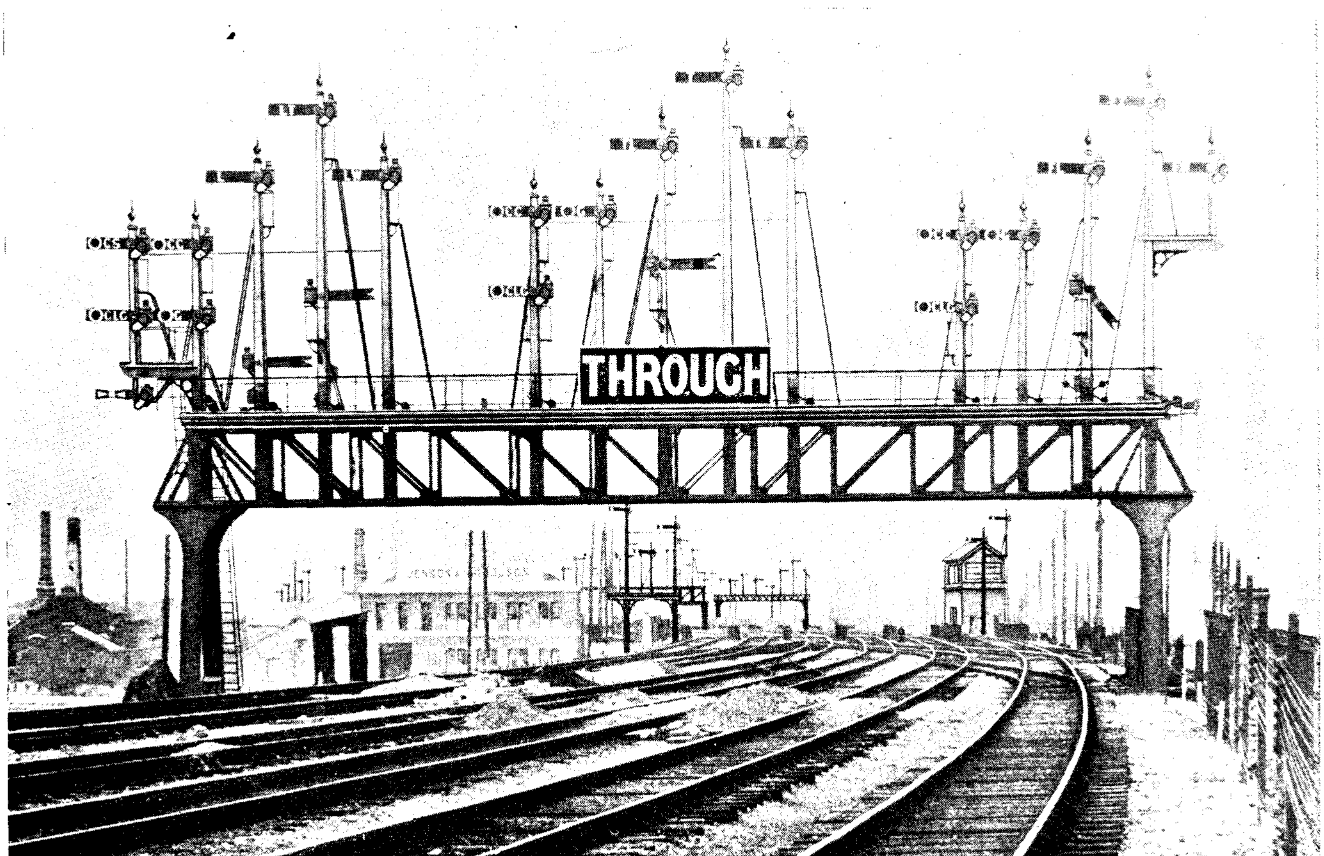


Fig. 4.

Touching upon gantries, I think from examination of the photo below, readers will agree that the Great Eastern could provide as impressive an array as one could wish for. The particular gantry used to span the main line a little to the west of Stratford. In addition to the somewhat flamboyant labelling of the fast-line signals, every individual arm had letters appropriate to the function, these white letters taking the place of the usual white stripe.

(To be continued)

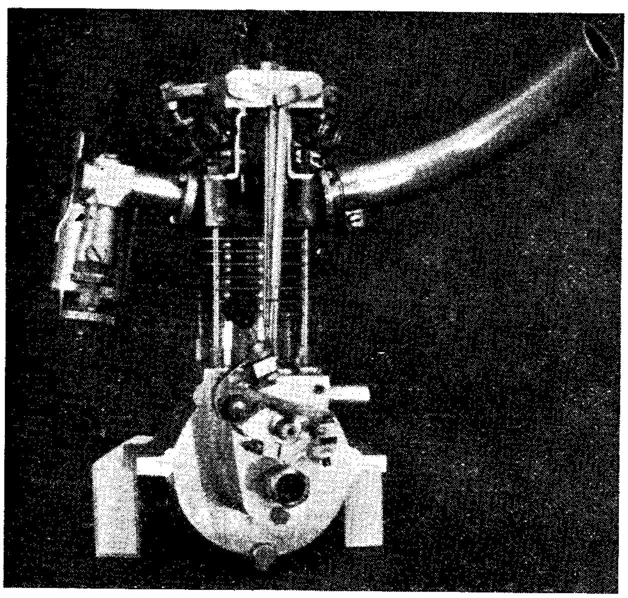


A 15 c.c. SPEED-BOAT ENGINE

By J. Orme

SEVERAL readers of THE MODEL ENGINEER have expressed interest in the engine of my model speed-boat, *Skua*, which won first place in class "C" of the 1939 "M.E." speed-boat competition, with a speed of 40.78 m.p.h. (the highest so far attained in this class in any British competition), so, with the Editor's permission, I am giving a few particulars and some photos of this engine.

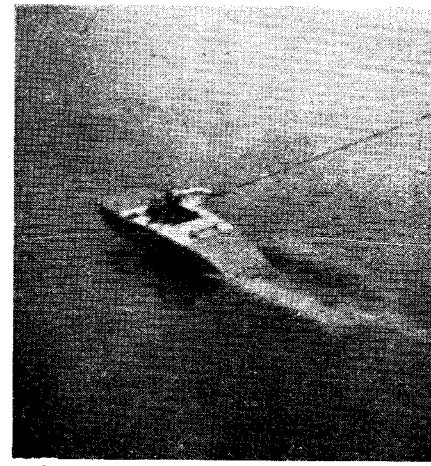
I have been actively interested in model speed-boats for several years now, but have had very little real success with any of my boats prior to that referred to above. My *role* at most of the regattas was that of the clown to provide comic relief to the spectators, but very often it was neither comic or a relief to me, and so I eventually decided to get right down to it for all I was worth, and design and construct my own engine. Having fully made up my mind about the design, I made a start on the engine construction by making



The 15 c.c. engine seen from timing end of shaft.

the crankcase patterns. In order to make certain of getting satisfactory castings, I did my own moulding at home, and the results were quite a success. The crankcase was then machined and fitted with ⅜-in. ball-races, which carry the crankshaft, the latter being turned from a solid bar of 3 per cent. nickel steel. It embodies internal flywheels, and is drilled for pressure lubrication.

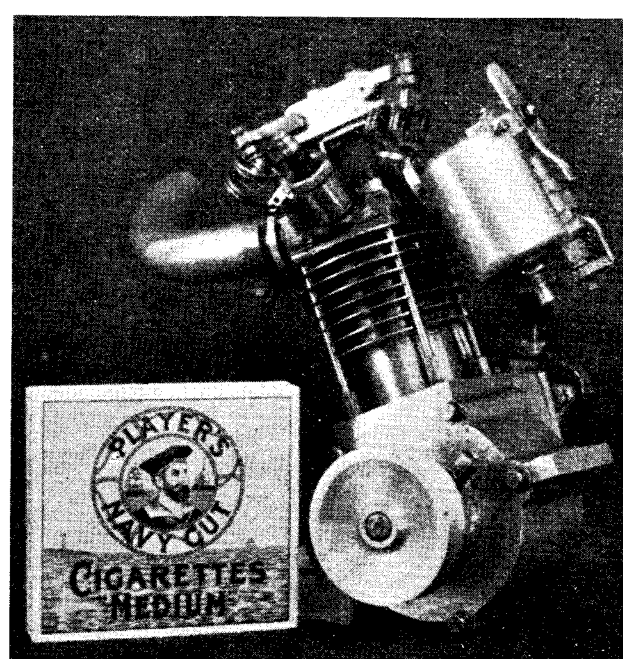
The connecting-rod is made from a ½-in. by 3-in. high-tensile bolt, and has a split big-end, with phosphor-bronze bearing, a bush of the same material being fitted at the little-end. A hole is drilled up the centre of the rod to convey oil to the little-end bush. The piston is die-cast by methods which are familiar to many readers of THE MODEL ENGINEER, but a few brief notes on the method may be useful. A brass tube, sufficiently large in the bore to provide machining allowance on the piston diameter, was used for



"Skua" running on the circular course.

the mould; this was left open at the top, and fitted with a 3-piece collapsible brass core to form the inside and the gudgeon-pin bosses. Before pouring the metal, the mould was heated to a black heat, and after pouring, the molten metal was well pressed down with a broom-handle to force out any air bubbles. This results in a clean, close-grained piston casting, with extra metal left on the crown, which not only serves as a chucking piece, but also provides a useful bit of stock material for future use.

The cylinder-head was laboriously chewed from a solid piece of close-grained cast-iron, mostly by hand, and required a good deal of patience. It is fitted with ⅜-in. valve ports, the passages being swept in a curve to the outer flanges, and tapered so that the inlet is 5/16-in. diameter at the flange face and the exhaust ½-in. diameter. Hairpin valve springs, working at a compression of 20 lb.,

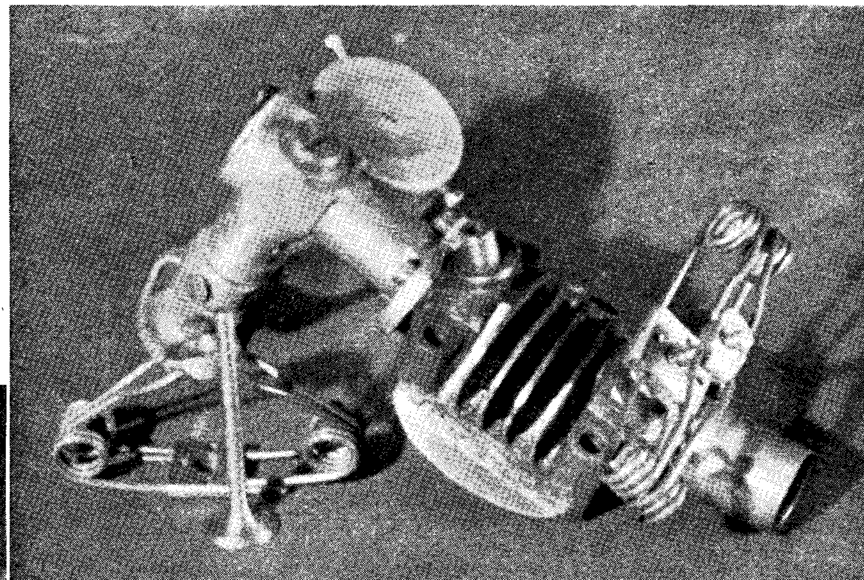


Another view of engine, which gives an idea of its dimensions.

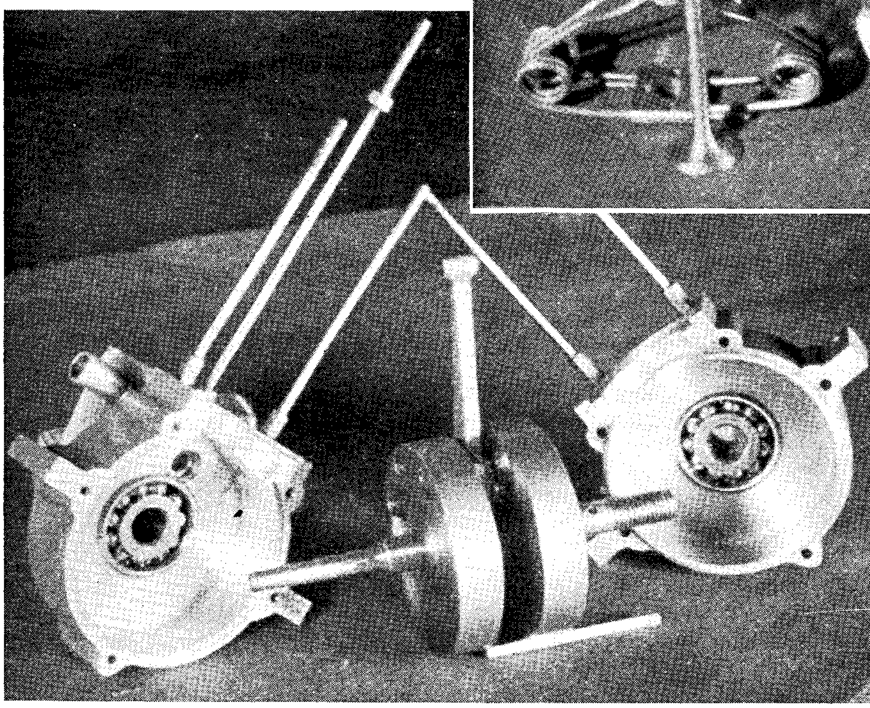
are fitted. I found it necessary to make a special sparking-plug with a copper electrode to stand up to the high internal temperature. An aluminium-alloy cylinder barrel is employed, with a pressed-in Centricast liner.

The valve tappets are fitted with $\frac{1}{4}$-in. rollers, having $\frac{1}{8}$-in. pivot pins, to reduce friction where they bear on the cams. A solid camshaft is used, machined from $\frac{5}{8}$-in. dia. silver-steel, the cams being ground, hardened and tempered. It runs on $\frac{1}{4}$-in. ball-races.

Hull dimensions of *Skua* are : length, 2 ft. 6 in. ; width of front plane, $10\frac{1}{2}$ in.; rear plane, 7 in. Propeller, $2\frac{5}{8}$ in. dia., 4 in. pitch, and 1 in. blade area (2 blades).



Above : The cylinder-head with one valve and spring dismantled.



Left : The crankshaft connecting-rod, and two halves of crankcase.

Using the Glass Cutter

It may be argued that the cutting of glass is outside the province of the model engineer, as such, but there are occasions when the necessity arises during the carrying out of a job—to say nothing of the necessity made all the more frequent from causes I need not specify !

To many—to judge from my own experience—the cutting of glass with a roller cutter or glazier's diamond is an art cloaked in mystery and not to be attempted at any cost. Provided the job is approached with calm confidence, cutting of the more common types of glass will be found absurdly easy.

The glass to be cut should rest in perfect contact with its supporting surface, which should be as flat as possible, e.g., a bench or table well padded with newspapers. If the glass does not appear to be flat (a surprising amount is bent !) place the hollow side down. Hold the cutter vertically, use a firm, steady pressure and make one cut only along the straight edge you are using as a guide. If the glass does not break easily, tap lightly with the cutter holder along the cut on the underside of the glass, or rest the cut over any convenient straight-edge and break the piece off with gentle pressure.

When it is necessary to cut an outside curved edge, lay the glass over the desired curve drawn on a piece of paper, make several cuts, say $\frac{1}{2}$ in. apart *outside* the curve, and break the glass away. Now make the final cut over the curve. If an outside curve is to be cut, make the correct cut and another, say 3/16 in. inside of it. Then make V-cuts on the waste glass and break it away with the slots in the cutter or with flat-nosed pliers.—L. A. WATSON.

A Novel Electric Clock Movement

By H. H. Ward

AT a Juvenile Instruction Centre situated "somewhere in the North West," it was decided to construct an electric clock which would incorporate at least one example of work from each of the "practical departments" of the school. Being at that time in charge of the "Workshop Science" Department, it fell to the writer to design and partly to construct, the actual timekeeping movement. In this school no machine tools were permitted in the workshops. Though this was splendid from the point of view of those who wished to improve the hand skill of the boys, it was not helpful in the matter of making a clock. There was, however, no rule against the writer "importing" his own "Adept" lathe for his own use, and in the same way, the Head Master, himself a practical horologist, brought down a very diminutive "Boley" watch lathe. Although the former lathe exceeded expectations on this job, it was doubtful if so good a result would have been obtained if it had not been for the Head Master's skill and patience in using the latter tool for such work as finishing hardened parts of the pivot type.

As there were difficulties in the way of cutting gears on either lathe, the writer let it be known throughout the school that he was collecting clock wheels, and soon there were plenty to choose from amongst a motley collection. A wheel of about $2\frac{3}{4}$ in. dia. with 200 teeth was found and

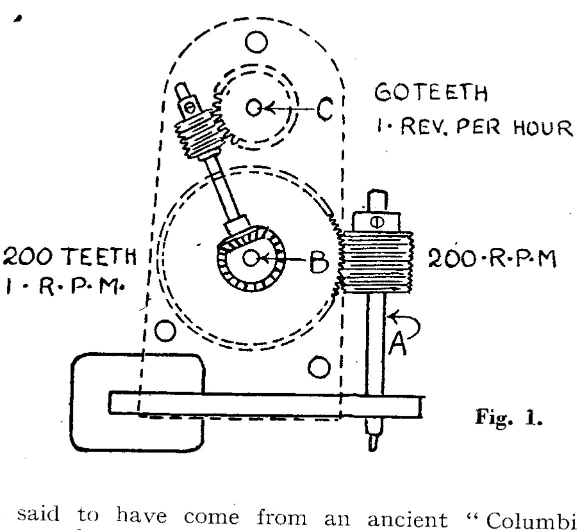


Fig. 1.

was said to have come from an ancient "Columbia" phonograph. This meshed as a worm wheel with a 26 t.p.i. thread, but the teeth were much battered through a long spell in a junk box. On taking "the innards" from a 50-light gas meter (dated on the inside 1878) it was found that all the large wheels in the counter were of 60 teeth and of clock tooth formation, and would function as worm drives against a 14 t.p.i. thread. A small pair of one-to-one bevels were available, and so the scheme shown in Fig. 1 was evolved. The view is from the rear, and the diagram is merely schematic and not to scale. A motor, running at 200 r.p.m. from time-controlled mains, drives the large wheel at one rev. per minute, or "seconds hand" speed via a single-start worm. At this point the drive is

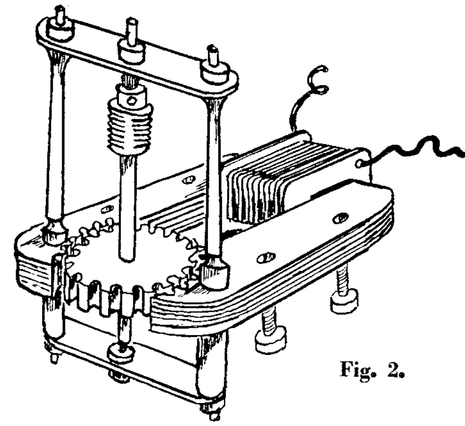


Fig. 2.

taken through a right-angle by the bevel wheels and a second worm gear step reduces the speed to one rev. per hour or "minute hand" speed. Thereafter, a motion work or "back of dial gearing" of 12 to 1 ratio controls the hour hand. For the worms, stock die cut threads of $\frac{1}{2}$ in. and 7/16 in. had to be used, as no screwcutting gear was to hand.

It will be seen that for teaching purposes this very direct and simple gearing is much better than long and, therefore, confusing trains of spur gears. It will also be seen that, as one may extend the worm shaft to the 60 tooth gear almost *ad lib.*, it is possible to construct a clock movement of this type to fit existing dials with any distance of spacing between the centre arbor and the seconds arbor. To save a long description, the 30-pole synchronous motor, with its $1\frac{3}{8}$ in. dia. rotor, is shown in the form of a rough sketch. The laminations of the rotor and yoke ("lamentations" as one boy called them) were of ordinary black sheet iron which had been used for other a.c. jobs with success. The shaft for the rotor was of the form shown in Fig. 3, and was of hardened steel with the pivots wrought up to a high finish by the Head Master, who was very expert with a pivot tool and "red stuff." It will be seen that the lubricant drains *into* and not *out of* these bearings when running vertically. Starting with clock oil, thicker and still thicker lubricants were tried in an endeavour to make these bearings run without a suspicion of a squeak. Finally, a perfect and almost everlasting lubricant for this light machine was found in roller-bearing grease for *lorries*. When first spun into synchronism, the motor started at once, ran for a couple of hours and was then stopped. After this, no man could tell what it would do next; it might run one minute or one hour; it might, and often did, reverse itself for several revs. before stopping with a jerk. After trying this and that (and dozens of other things) the motor was tested with a sensitive magnetometer and found to be a slight but definitely permanent magnet. It was, therefore, taken down for annealing, and then there were "lamentations," for the whole thing had been brought up to a "near mirror" polish!

After annealing these parts the motor functioned perfectly, but one had to learn the exact degree of "flick" needed by the rotor before it could be started with certainty. The plates of the clock, shown as dotted lines in Fig. 1, were bent under at right-angles at the base, and were equipped with slotted holes for the holding-down screws of the motor. The motor could thus be moved in or out of the plates to alter the mesh of the worm. In spite of a very expert but tedious reconstruction of the teeth of the 200 tooth wheel with a clock tooth file, and the deepening of the thread of the worm by the Head Master, this operation was so difficult that a vernier screw adjustment was contemplated. Fig. 4 shows how the meshing difficulty was dodged in the case of the 60 wheel. The end of the seconds hand shaft was turned down and ran in a

screwed and shouldered bush. This held the device shown, in which the bevel shaft ran, so that it could be moved into deeper or shallower mesh and still remain tangential.

When the suggestion for "a clock" was made in the staff room, the staff took sides over the question of "what kind of a clock?" As the centre of the school was built as a merchant's country seat at the time when the Slave Trade was making fortunes for such men, it was suggested by the "Arty" side that nothing but a long case clock of "the period" would do. The "Crafty" (sorry) Technical" side opposed this on the grounds that long cases were a necessary evil in the days when one could only measure time with dropping weights and a long pendulum, but would be an anachronism with an electric movement. The Woodwork Instructor, neutral so far, pointed out that the long case would give his department a much longed for chance of showing what they could do in the matter of miniature diamond panelling in English oak. He also pointed out that a wall clock would necessitate the plugging of the historic walls and that the Clerk of Works would thereupon "raise Cain." The "Long Casers" won !

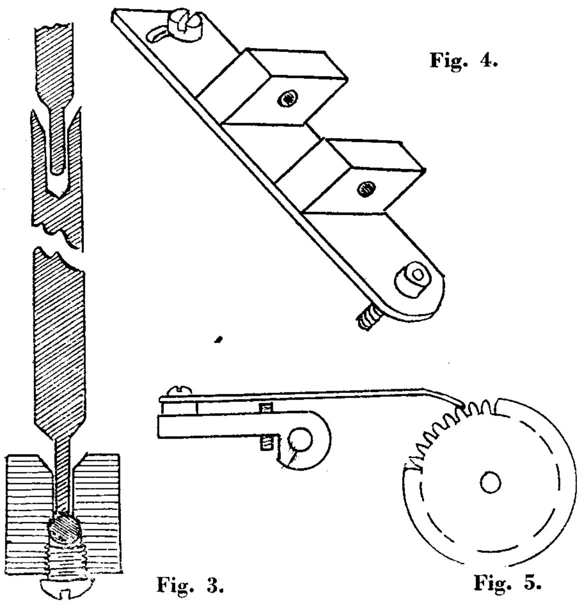
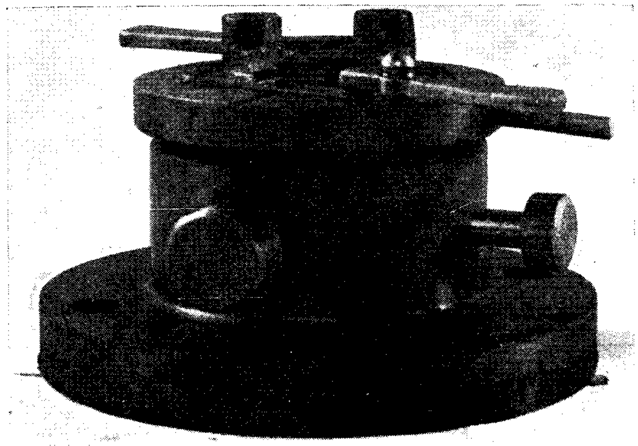


Fig. 4.

Fig. 3.

Fig. 5.

Due to its careful construction, the movement was almost dead silent, and after one very distinguished visitor had remarked that "It is a great pity that it has stopped," it was decided that, although purists might object, it must henceforth have a "tick," if only to silence the jeers of the latter at the "Silent Grandpop." It should be explained that no seconds hand had been fitted, nor was the dial designed for one, hence the doubt as whether the clock was in motion or not. The "ticker" shown in Fig. 5 had a phosphor bronze spring tapering both ways, and when gathered by the tooth of an extra 60 wheel on the minute shaft, it performed a series of evolutions when released. First the spring hit the stop screw and then the end curled down and tapped the next tooth on the wheel, after which it trembled slightly between the two teeth. The noise of these operations was amplified by the brass dial to which the movement was rigidly fitted and thus gave rise to a very realistic imitation of the wheezy "tickety tick-tock" sound emitted by a genuinely ancient and much-worn weight clock. To render it safe for demonstration purposes, the clock operated on 5 volts obtained from the mains via a bell transformer housed in the case.



Making a Vertical Dividing-Head

By H. W. Attree

TO complete the machining operations on a number of steel stampings, several grooves having a radius of 0.25 were required to be milled, and as these were arranged at a definite angle in relation to the centre of the stamping, a vertical dividing-head was essential to ensure the accuracy of the milling operations.

As this attachment was not available, it was decided to make one up from such materials and parts that were to hand; this comprised an old line shaft coupling of the type provided with a flange for bolting purposes, a casting for a lathe chuck back-plate, and an odd length of heavy gauge steel tube.

The back-plate casting was first machined all over, and the steel tube turned outside and bored to a tight press fit on the boss, the object of this extension being to provide adequate support in the base, as this part forms the revolving work table.

The flanged coupling was then machined up and bored to take the table, care being taken to ensure a good working fit here, the existing holes in the flange provided the means of bolting to the machine table.

The indexing positions were then marked off by setting the revolving table up in the lathe and fitting a suitable change-speed wheel to the mandrel stud, with a pointer to engage the teeth; a screwcutting tool clamped on its side in the tool-post was used to mark the positions—these were then drilled and reamed ½ in. dia.

One hole was also drilled and reamed in the base to take a hardened plunger with a knurled head to locate the various positions of the table, a further hole was drilled and tapped to take a ⅜ in. dia. brass locking screw, the head of which was knurled and drilled to take a tommy bar.

A button in the centre of the table engaged a machined hole in the stamping and this, together with two small dowel pins, located the position.

To facilitate quick loading and unloading, two levers were fitted as illustrated, which operated with a cam action when tightened.

Apart from being used for work of a special nature, a dividing-head of this description can easily be adapted to take a three- or four-jaw chuck, and its usefulness is then further extended for a variety of milling jobs, such as making squares and hexagons on round stock, or slotting screws, etc., and in addition, can be used on the drilling machine where a number of holes have to be accurately spaced and drilled, the necessary indexing positions being added as required.

Letters

Early Model Engineering

DEAR SIR,—I was much interested in "L.B.S.C's." remarks on the Archaeology of Model Engineering. I have never heard of Pocock's book of 1888, but I did have a copy of Alexander's. My copy suffered from hard wear, it became delapidated and finally disappeared.

Anterior to these works there was, however, a very considerable source of information in that splendid journal "The Boy's Own Paper." In volume 10—1887-8, there was a series of articles by H. F. Hobden on Model Locos. The first had a 2-2-2 wheel arrangement with no cab nor even a wind screen, and it was spirit-fired. Soldering was commonly employed but Hobden certainly gave very careful instructions how brazing might be done. There were two inside oscillating cylinders. A sketch was given of each part, but all dimensions were in the text, an objectionable arrangement. This is a feature where THE MODEL ENGINEER shows a vast improvement, its line drawings, properly dimensioned, being of the highest class.

In these early days descriptions of mechanical manufacturing processes were very vague. For instance, you were instructed to "turn the driving wheels and drill them, and secure them to the axle by solder." Again "the crankshaft must be hammered up to shape, making it hot occasionally in the gas flame whilst working it." Later, you are instructed to "ease the crank at 'A' (the crank pin)," but how?

Boiler-making hints were also very vague.

Scale Drawings

Another loco. was of the 2-4-0 arrangement for 6½ in. gauge and Hobden commences his instructions with the following—"You will find it a great help if you carefully sketch on a sheet of cartridge paper the loco. of the exact size you intend making it." All along Hobden and his fellow contributors to the B.O.P. fully realise the desirability of scale drawings or sketches.

This locomotive had two outside cylinders 1¾ in. × 2½ in. and a boiler 5 in. diameter × 28 in. It was built on a flat steel plate with pierced side frames, spring buffers and mahogany buffer beams. It had spring-mounted axleboxes and axles ¾ in. diameter and Stephenson's link reverse. Again, the construction of the boiler and pipe-work was not sufficiently explanatory and would tax even an experienced mechanic. It does, however, recommend that after lightly riveting, the boiler ought to be taken to a good brazier to have every seam properly hard-brazed, and it goes on to say that "if this is well done you never need be in fear when the water runs low, as the boiler might get almost red hot without injuring it much." He suggests insulating the barrel by a flannel lagging with an outer plate of tin.

In volume 30, 1890, there is an article on how to make a small dynamo, by R. A. R. Bennett. It was a two-pole undertype machine with a shuttle armature. Here again the diagrams are good, but all dimensions are given in the text. I made this model, but instead of using soft cast-iron as instructed, I built up the magnet from mild steel slabs.

These articles mention Hopkins' "Experimental Science," which is an extremely interesting and well illustrated book. It also mentions another name very helpful to juniors in these early days, S. R. Bottone.

In the same volume is a series of articles on how to make electric toys such as a drum, a doll, a trumpet, etc.

In volume 11, 1888, Hobden gave a series of articles on how to build a fire-engine. His first chapter is devoted to lathes, grindstones, tools, etc. He considers a lathe necessary to make this model, as "paying a skilled workman would soon exhaust a schoolboy's pocket money, and, moreover, you would not have the satisfaction of knowing it was all your own work when finished."

In these early days nothing could be bought from stock. If castings were required you had to make your own pattern. Hobden suggests that great care shoud be taken over your patterns. They should be sand-papered smooth and black-leaded, and brushed bright in order to get smooth castings. For making wheel and disc patterns he suggests taking three thicknesses of wood, crossing the grain and glueing them up tight. Nowadays we use multi-ply wood.

As each piece is finished he suggests painting it and putting it away till required. My experience is that it is better to leave everything in the rough until final erection and test, after which dismantle the model and then paint.

Brass Wire

One curious expression constantly recurs. Round brass up to ⅝ in. diameter is described as "brass wire."

Pressure gauges in these days were very expensive from 30/- to 40/-, but Hamley, of 231, High Holborn, had them at 10/-. This is a new name to me.

Going further back, the *B.O.P.* in 1884 described the construction of a steam injector for models and mentioned that these were touchy things to handle and required careful making.

About 1887 a table bell was described in the form of a steering-wheel. I very nearly made this, and it is only a few months ago that I destroyed the spokes of the wheel.

My experience of these early days is that practically all model making was done by working mechanics who preferred an interesting hobby to spending their evenings in the local hostelry. They were very good at plate work such as boilers, etc., which could be made without machine tools. Their engines, pumps, etc., were not so good. Lathes and drilling machines were simply not obtainable in those days. What lathes there were were quite primitive and few had a slide rest. For this reason most engines in these days were built up by riveting, soldering or brazing.

I often wonder what became of these early efforts.

Yours sincerely,

Norwich. H. O. CLARK.

Stirrup Pumps

DEAR SIR,—With reference to your editorial article on fire protection, I would like to say that I have now made up three stirrup pumps from the instructions given by "Artificer," and these have now been distributed. I feel that I made a good job of the work, and followed the instructions exactly except for the spray nozzle. The makers of garden and fruit sprayers have only been able to make an efficient spray by a combination of a jet and two jets within that jet, as it were, a much more delicate piece of work than the simple chamfered hole as prescribed for the stirrup pump, and having bought a standard stirrup pump combination jet as a model, I found it to be very inefficient and I felt that the work involved in making these up was waste of time. I have, therefore, made one jet only and have instructed the users to place their finger against the water when the spray is required, and in practice this works better than the standard spray. As regards fool-proof working, it is no easier to remember to push the control over from one position to another than it is to put the finger against the water or remove it from the water; also, in the latter case there is less to go wrong or get broken.

Yours faithfully,

Cranleigh. KENELM ARMYTAGE.

Ball-bearings on Lathes

DEAR SIR,—I was interested in Mr. R. T. Fletcher's remarks concerning his lathe. I possess the $3\frac{1}{2}$ in. "Union" plain power-type lathe with countershaft, and it is fitted with a combined radial and axial load ball-race, having one row of balls. The spindle appears to be entirely free from play and runs so freely that it continues to revolve for a short time after the countershaft pedal is released. I have turned down to 0.3 mm. diameter with a graver and also faced irregular objects held in the four-jaw chuck. There is a tendency to chatter when taking light cuts off shoulders, but this does not occur if the depth of cut is increased. The ball-race or its housing springs visibly when thrust is applied with the tailstock.

The slide-rest supplied with this "Union" lathe is unsatisfactory, as the top slide travels only $2\frac{1}{4}$ in., whereas the usual length for a plain lathe of this size is $3\frac{1}{2}$ in. For swivelling, a spigot, projecting downwards from the top slide, enters a hole in the cross slide and is secured only by a radial set-screw.

Would any reader who has had opportunity to observe the more unusual employment of ball-races, give his views as to the wisdom of fitting lathes with them ?

Yours faithfully,

St. Albans. "CENTRE FORWARD."

Hull Design

DEAR SIR,—Mr. D. Bains' letter in THE MODEL ENGINEER of March 6th on forward drive for cars and boats, raises a point on which I think I can give him some information.

When I converted my boat *Roberti* from flash steam to I.C. engine propulsion, I re-designed it with the propeller about 1/3rd of the length from the front of the boat, on the style of Mr. Jeffrey's design. This arrangement produced some queer results in practice. With the engine at only half throttle the boat would go for half to one-and-a-half laps before either turning right round in its tracks, or turning over. I found that this was due to the propeller bracket acting as a fin, in front of the line attachment. If the boat got only slightly off its true course, the bracket would push the front of the boat even more off its course, so that it turned it round or over. Instead of stabilising the boat it had the reverse effect. To try and correct this a stabilising fin was fitted at the rear of the boat. While this made an improvement it was still very unreliable. On trying the boat with the throttle fully open, the boat did even more antics. It would go round with the front bouncing up and down, lifting right out of the water for as long as it stayed right way up. The maximum speeds were in the region of 20 m.p.h.

After this the boat was again converted, the propeller being at the rear, as is normal practice, from which no deviation has yet been made.

Although you would not get effects such as these in a racing car, the fact is that when a car is accelerating, the inertio tends to lift the front of the car, thus decreasing the adhesion weight on the front wheels and increasing the weight on the rear wheels, where extra adhesion is very welcome. Even then, wheel spin is quite common at the lower speeds. It seems to me that as b.h.p's. are increasing, four-wheel drive will have to be used to prevent excessive wheel spin and so get the utmost advantage from the increased h.p. In short, my opinion is that front propeller drive on boats is not a success, and front wheel drive on cars will only be used to supplement the rear wheel drive.

While on the subject of cars, I would like to say how very interesting were the reports of model car racing in America. After reading them, I had an idea which I think would increase the enjoyment and thrill considerably. It is this :—The cars are at present, I believe, run attached to a line like a speed boat. Now if a track was built for the cars, with a concave surface and properly banked concave corners, the cars could steer themselves if they were fitted with gyroscope connected to the steering, the idea being that if the car tilted to one side or the other, such as would happen if it deviated from the centre of a concave track, the gyroscope would turn the steering and so bring the car to the centre of the track. Of course, this is only the bare outline. Centrifugal force would have to be taken into account, for instance. But I think it could be made to work. It would be possible to run two cars together by setting the steering so that each car ran on either side of the centre of the track.

Mr. Westbury spoke in his article of a contemporary writer who did not seem to appreciate the progress made in model I.C. engines. Perhaps this writer will change his mind a little when I say that I have about finished a design for a four-cylinder 30 c.c. I.C. engine, with high pressure supercharger and rotary valves of my own design, which I believe will be an improvement on the cross type of valve.

Yours faithfully,

Radford. A. C. HUTTON.

Clubs

The Harrow Model Engineering Society

The next meeting will be held on Easter Sunday, April 13th, at the Society's track, Kenton Grange, Kenton, from about 2.30 p.m.

Hon. Sec. : A. D. POLE, 13, Churchfield Close, North Harrow.

The Junior Institution of Engineers

The Council of the Junior Institution of Engineers has decided to resume the Friday evening meetings, but restrict the time from 6 to 8 p.m.

Friday, 18th April, 1941, at 39 Victoria Street, S.W.1, at 6 p.m. Ordinary meeting. Paper : "Fittings and their effect on the Efficiency of Supply Lines," by S. J. Moore (Associate Member and Durham Bursar).

Friday, 18th April, 1941, at the Sheffield Metallurgical Club, West Street, Sheffield, Sheffield Section, when Mr. A. V. Jobling (Member) will open a discussion evening. Time 6.30-8 p.m.

The Chelmsford Society of Model Engineers

The General Meeting of the Society, held on Saturday, 22nd March, in Toc H Rooms, was attended by a large number of members. Reports were read and adopted, showing a healthy position financially and otherwise. Election of officers resulted in the present officers being re-elected with the exception of Chairman, which was filled by Mr. R. Bishop. A pleasing feature of the meeting was the election of Mr. J. J. Clarke as Vice-President. It was perhaps a significant omen that the "Raiders Passed" signal sounded at the commencement of the meeting.

Hon. Sec.: JOHN L. C. DICKSON, "St. Leonard's," 159, Wood Street, Chelmsford.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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